Nokia Customer Care

# *Service Manual*

## RM-178; RM-106; RM-199 (Nokia 6125; Nokia 6136)

# Mobile Terminal

***Part No: 9250239 (Issue 2)***

***COMPANY CONFIDENTIAL***

NOKIA

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## Amendment Record Sheet

| Amendment No | Date | Inserted By | Comments |
|---|---|---|---|
| Issue 1 | 04/2006 | J-PH | |
| Issue 2 | 09/2006 | ET | The RM-106/199 (Nokia 6136) information has been updated. Updates have been made as follows:<br>**New chapters:**<br>• RM-106/199 component parts list (2-30)<br>• RM-106/199 component layout - top (1PF_05bb) (2-51)<br>• RM-106/199 component layout - bottom (1PF_05bb) (2-52)<br>• Introduction to WLAN troubleshooting (7-39)<br>• WLAN functionality test using SB-7 and Phoenix (7-41)<br>• WLAN failure troubleshooting (7-42)<br>• RM-106/199 WLAN (8-10)<br>• RM-106/199 schematics (10)<br>**Updated chapters:**<br>• RM-178/106/199 product selection (1-5)<br>• RM-178/106/199 product features and sales package (1-6)<br>• Product and module list (1-7)<br>• Mobile enhancements (1-8)<br>• Exploded view (2-5)<br>• Mechanical spare parts overview (2-6)<br>• Mechanical spare parts list (2-6)<br>• RJ-84 soldering jig (4-12)<br>• Service concept for GSM, WCDMA, and WLAN RF testing and RF/BB tuning (4-21) |


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## IMPORTANT

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## Warnings and cautions

### Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

### Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- During testing never activate the GSM transmitter without a proper antenna load, otherwise the GSM PA may be damaged.


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## ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.


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## Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.


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Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

Please state:

- Title of the Document + Issue Number/Date of publication
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## Battery information

**Note:** A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.


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# Nokia 6125; Nokia 6136 Service Manual Structure

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2 Parts Lists and Component Layouts
3 Service Software Instructions
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6 BB Troubleshooting and Manual Tuning Guide
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# 1 — General Information

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## RM-178/106/199 product selection

Nokia RM-178/106/199 support 850/900/1800/1900 MHz bands. RM-178/106/199 will support EGPRS packet data connection (EDGE) in all these bands. Supported multislot class for both GPRS and EGPRS is MSC 10. RM-178/106/199 is based on G3.1S, RAP GSM engine.

According to GSM standard 05.05 it responds to class 4 (max. 2W) in EGSM 900, class 1 (1W) in GSM 1800 and class 1 in GSM 1900. It also supports Bluetooth 2.0 + EDR standard. The handset has a full phase 2 Type Approval and it complies with the GSM Type Approval. RM-178/106/199 also has a full CE approval and FCC approval.

Phone has 1.3 megapixel camera with integrated flash and with digital zoom up to 8x. Phone displays used as viewfinders: the larger display for normal pictures; the small external display for self-portraits. Main display resolution is 128x160 and supports 262, 144 colours. External mini display resolution is 96x65 and supports 65,536 colours.

RM-178/106/199 have stereo FM radio and music player and supports microSD card with hotswap possibility

The MMS implementation follows the OMA MMS 1.2, AMR and SMIL.

WAP 2.0 compatible XHTML browser over HTTP/TCP/IP stack communicates with a gateway in network.

The supported UI is S40, i.e. RM-178/106/199 software is based on ISA platform.

**Figure 1 View of RM-178 - Nokia 6125**


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**Figure 2 View of RM-106/199 - Nokia 6136**

## RM-178/106/199 product features and sales package

### Imaging

- 1.3MPix camera (resolution 1280 x 1024 pixels) with dedicated camera button, and 8x smooth zoom
- Phone displays used as viewfinders: use the larger display to take normal pictures; use the small external display for self-portraits
- Standard, night, and sequential shot modes; self-timer
- Gallery for storing and editing images
- Three image-quality options: high, normal, basic
- Integrated video recorder: 3GPP spec (H.263 video and AMR audio packed in .3gp format)
- Video resolution: QCIF (176 x 144 Pixel), 15 frames per second
- Video capture time: Up to 5 min

### Bearers & transport

- Quadband EGSM 900, GSM 850/1800/1900 supporting EDGE (rel. 99)
- Automatic switching between bands

### Software platform

- SW platform: Nokia Series 40

### Connectivity

- WLAN 802.11 b/g 2.4 Ghz for UMA, with automatic switching between WLAN and cellular networks


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**Note:** RM-106/199 only.

- USB 2.0 full-speed
- Bluetooth 2.0

**Note:** RM-178 only.

- Pop-Port™ connector with ACI
- IrDA (1 Mbit/s)
- Support for SIM Access Profile (SAP)
- Remote or local synchronization with a PC or other compatible device

## Productivity

- PIM (Calendar & Contacts)
- Internet browser
- Video streaming (3GPP)
- Logs (last calls , timers and history list)
- Audio messaging
- Java™ MIDP 2.0, CLDC 1.13D API, PIM API, File access API
- MP3
- Data Transfer
- Settings Wizard/Access Point Configurator

## Sales package

- Transceiver RM-178/106/199
- BL-4C
- AC Charger
- All-in-one User Guide (warranty card + accessory info + getting started sheet + invitational module for Club Nokia )
- CD-ROM
- Stereo Headset HS-23

## Product and module list

**Table 1 RM-178**

| Module name | Type code | Notes |
|---|---|---|
| Upper Module | 1PJ | Connectors for display, UI PWB, HWA camera, IHF and earpiece. |
| Lower Module | 1VA | Main PWB with components. |
| Coaxial Cable | NKAW | The cable between the upper and lower module. |


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**Table 2 RM-106/199**

| Module name | Type code | Notes |
|---|---|---|
| Upper Module | 1PJ | Connectors for display, UI PWB, HWA camera, IHF and earpiece. |
| Lower Module | 1PF | Main PWB with components. |
| Coaxial Cable | NKAW | The cable between the upper and lower module. |

## Mobile enhancements

**Table 3 Audio**

| Enhancement | Type |
|---|---|
| Boom mono headset | HDB-4 |
| Mono headset | HS-5 |
| Classic stereo headset | HS-23 |
| Loopset | LPS-4 |
| Wireless headset | HDW-3 |
| | HS-4W |
| | HS-11W |
| Wireless clip-on headset | HS-21W |
| Wireless stereo headset | HS-12W |
| Music stand | MD-1 |

**Table 4 Car**

| Enhancement | Type |
|---|---|
| Nokia car kit phone | N616 |
| Headrest handsfree | BHF-3 |
| Basic handsfree | HF-3 |
| Advanced car kit (sales pack) (EURO 1) | CK-7W |
| Car kit | CK-10 |
| Plug-in car handsfree | HF-6W |
| Mobile holder | CR-44 |

**Table 5 Data**

| Enhancement | Type |
|---|---|
| Connectivity cable | CA-53 |
| PC suite | |


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**Table 6 Imaging**

| Enhancement | Type |
|---|---|
| Nokia image album | PD-1 |
| Nokia remote camera | PT-6 |

**Table 7 Messaging**

| Enhancement | Type |
|---|---|
| Nokia digital pen (Eur/US) | SU-1B |
| Bluetooth QWERTY keypad (Scandinavian EURO 1) | SU-8W |

**Table 8 Power**

| Enhancement | Type |
|---|---|
| Compact charger | AC-3 |
| Battery Li-on | BL-4C |
| Travel charger | AC-4 |
| Retractable charger | AC-1 |
| Charger adapter | AC-44 |
| Mobile charger | DC-4 |

## Technical specifications

### Transceiver general specifications

| Unit | Dimensions (L x W x T) | Weight (g) | Volume ($cm^3$) |
|---|---|---|---|
| Transceiver with BL-4C battery | 90x46x23.6mm | 98 | 85 |

### Main RF characteristics for GSM850/900/1800/1900 (quadband) and EDGE phones

| Parameter | Unit |
|---|---|
| Cellular system | GSM850, EGSM900, GSM1800/1900 and EDGE |
| Rx frequency band | GSM850: 869 - 890 MHz |
| | EGSM900: 925 - 960 MHz |
| | GSM1800: 1805 - 1880 MHz |
| | GSM1900: 1930 - 1990 MHz |


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| Parameter | Unit |
|---|---|
| Tx frequency band | GSM850: 824 - 849 MHz |
| | EGSM900: 880 - 915 MHz |
| | GSM1800: 1710 - 1785 MHz |
| | GSM1900: 1850 - 1910 MHz |
| Output power | GSM850: +5 ... +33dBm/3.2mW ... 2W |
| | GSM900: +5 ... +33dBm/3.2mW ... 2W |
| | GSM1800: +0 ... +30dBm/1.0mW ... 1W |
| | GSM1900: +0 ... +30dBm/1.0mW ... 1W |
| EDGE output power | EDGE850: +5 ... +29dBm/3.2mW ... 2W |
| | EDGE900: +5 ... +29dBm/3.2mW ... 2W |
| | EDGE1800: +0 ... +26dBm/1.0mW ... 1W |
| | EDGE1900:+0 ... +26dBm/1.0mW ... 1W |
| Number of RF channels | GSM850: 124 |
| | GSM900: 194 |
| | GSM1800: 374 |
| | GSM1900: 299 |
| Channel spacing | 200 kHz |
| Number of Tx power levels | GSM850: 15 |
| | GSM900: 15 |
| | GSM1800: 16 |
| | GSM1900: 16 |
| Number of EDGE Tx power levels | GSM850 EDGE: 12 |
| | GSM900 EDGE: 12 |
| | GSM1800 EDGE: 14 |
| | GSM1900 EDGE: 14 |

## Battery endurance

| Battery | Capacity (mAh) | Talk time | Stand-by |
|---|---|---|---|
| BL-4C | 820mAh | up to 2-5 hrs | up to 160-280 hrs |

## Charging times

| AC-3 |
|---|
| Up to 2 hrs 20 mins |


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## Environmental conditions

| Environmental condition | Ambient temperature | Notes |
|---|---|---|
| Normal operation | -15ºC...+55ºC | Specifications fulfilled |
| Reduced performance | -25ºC...-15ºC<br>+55ºC...+70ºC | Operational for shorts periods only |
| Intermittent operation | -40ºC...-15ºC<br>+70ºC...+85 ºC | Operation not guaranteed but an attempt to operate does not damage the phone. |
| No operation or storage | <-40ºC...>+85ºC | No storage or operation: an attempt may damage the phone. |
| Charging allowed | -25ºC...+50ºC | |
| Long term storage conditions | 0ºC...+85ºC | |


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# 2 — Parts Lists and Component Layouts


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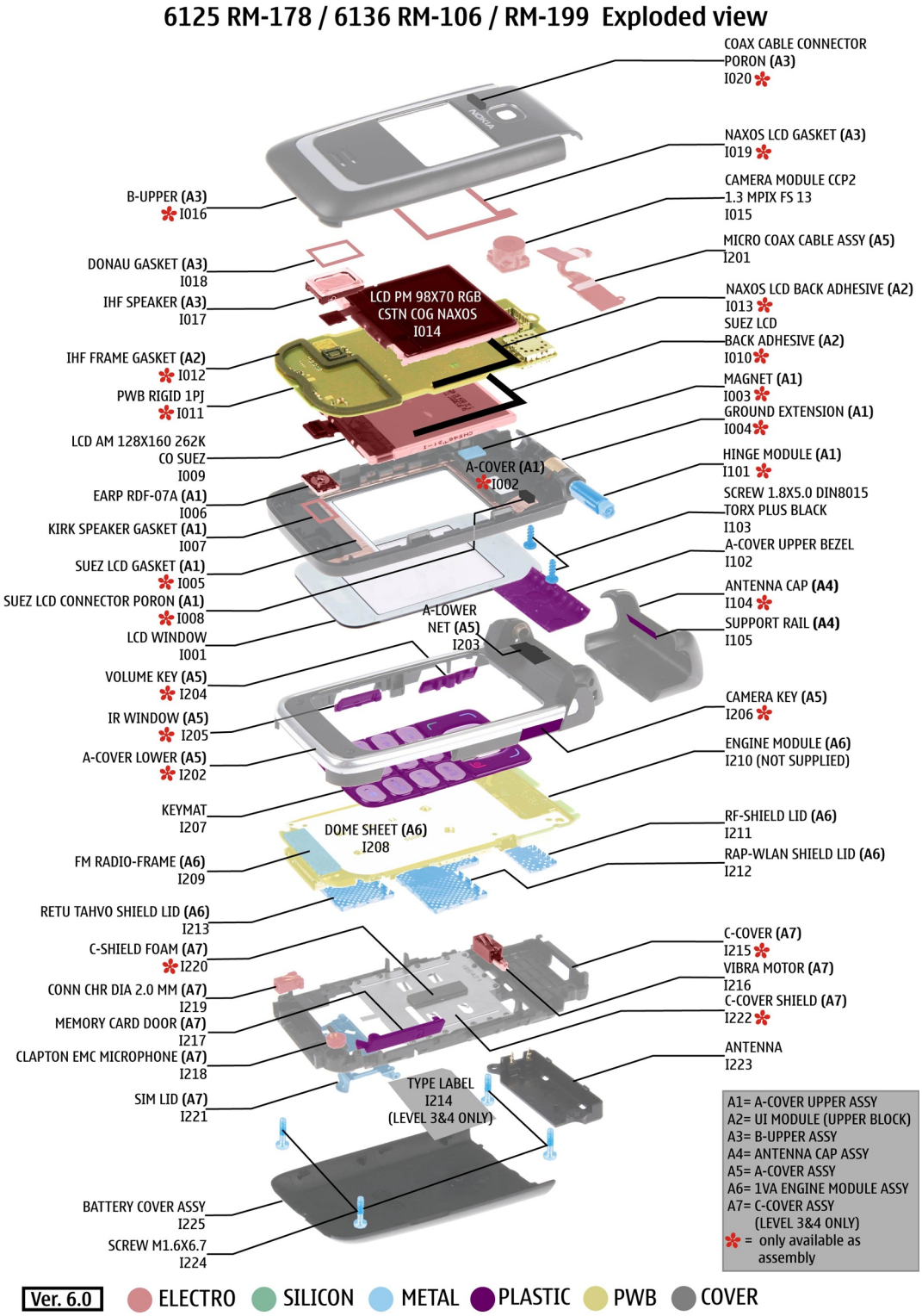
## Exploded view

### Exploded view





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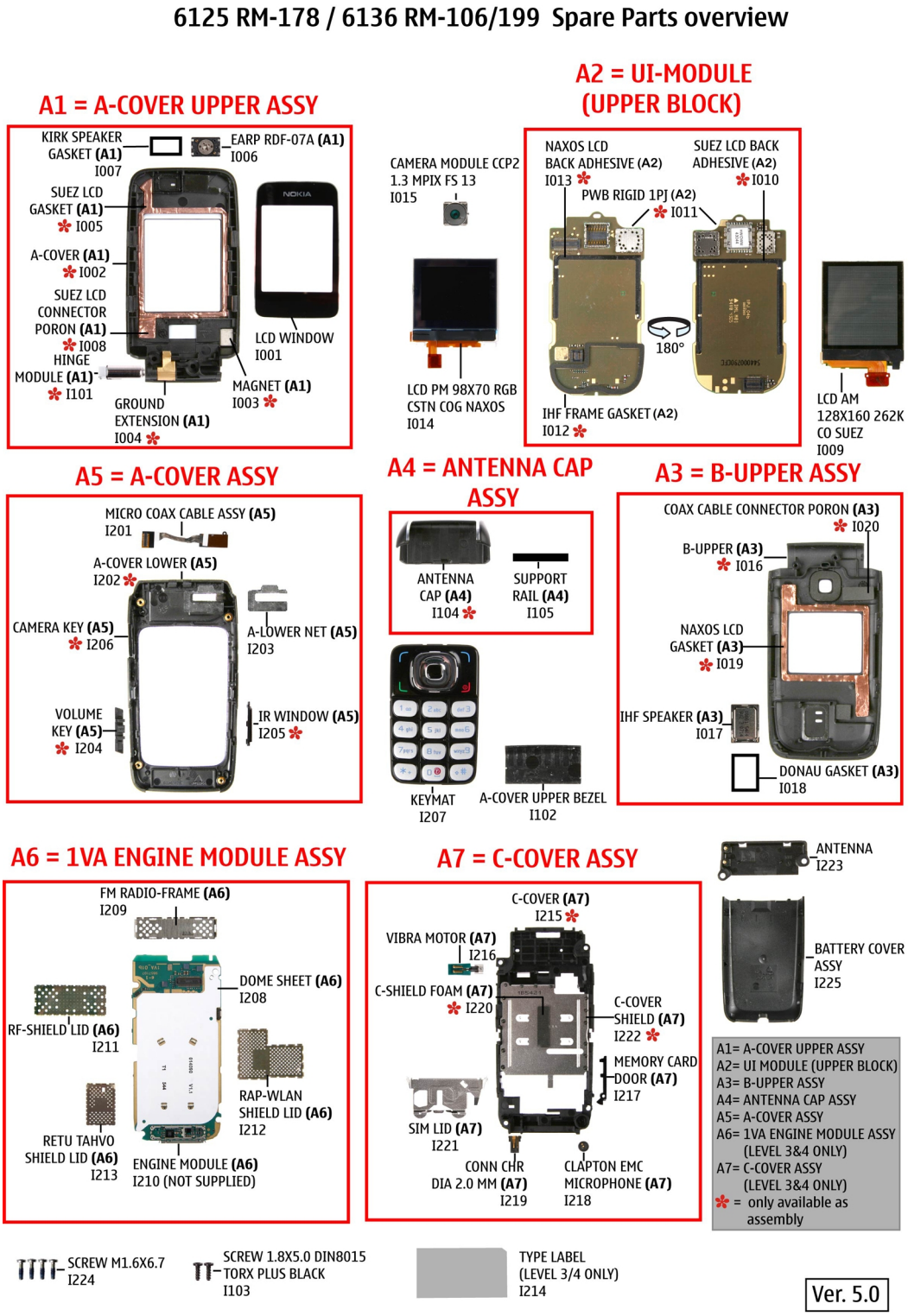
## Mechanical spare parts overview




## Parts lists

## Mechanical spare parts list

**Note:** For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS).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To ensure you are always using the latest codes, please check the PWS on a daily basis.

| ITEM/CIRCUIT REF. | PART NAME |
|---|---|
| **A1** | **A-COVER UPPER ASSY (I001 - I008, I101)** |
| I001 | LCD WINDOW |
| I002 | A-COVER |
| I003 | MAGNET |
| I004 | GROUND EXTENSION |
| I005 | SUEZ LCD GASKET |
| I006 | EARP RDF-07A |
| I007 | KIRK SPEAKER GASKET |
| I008 | SUEZ LCD CONNECTOR PORON |
| I101 | HINGE MODULE |
| | |
| I009 | LCD AM 128x160 262K CO Suez |
| | |
| **A2** | **UI MODULE (UPPER BLOCK) (I010 - I013)** |
| I010 | SUEZ LCD BACK ADHESIVE |
| I011 | PWB RIGID 1PJ |
| I012 | IHF FRAME GASKET |
| I013 | NAXOS LCD BACK ADHESIVE |
| | |
| I014 | LCD PM 98x70 RGB CSTN COG NAXOS |
| I015 | CAMERA MODULE CCP2 1.3 Mpix FS13 |
| | |
| **A3** | **B-UPPER ASSY (I016 - I020)** |
| I016 | B-UPPER |
| I017 | IHF SPEAKER |
| I018 | DONAU GASKET |
| I019 | NAXOS LCD GASKET |
| I020 | COAX CABLE CONNECTOR PORON |
| | |
| I102 | A-COVER UPPER BEZEL |
| I103 | SCREW 1.8X5.0 DIN8015 TORX PLUS BLACK |
| | |
| **A4** | **ANTENNA CAP ASSY (I104 - I105)** |
| I104 | ANTENNA CAP |
| I105 | SUPPORT RAIL |
| | |
| **A5** | **A-COVER ASSY (I201 - I206)** |
| I201 | MICRO COAX CABLE ASSY |
| I202 | A-COVER LOWER |


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| ITEM/CIRCUIT REF. | PART NAME |
|---|---|
| I203 | A-LOWER NET |
| I204 | VOLUME KEY |
| I205 | IR WINDOW |
| I206 | CAMERA KEY |
| | |
| I207 | KEYMAT |
| | |
| **A6** | **1VA ENGINE MODULE ASSY (I208 - I213)** |
| I208 | DOME SHEET |
| I209 | FM RADIO-FRAME |
| I210 | ENGINE MODULE |
| I211 | RF-SHIELD LID |
| I212 | RAP-WLAN SHIELD LID |
| I213 | RETU-TAHVO SHIELD LID |
| | |
| I214 | TYPE LABEL |
| | |
| **A7** | **C-COVER ASSY (I215 - I222)** |
| I215 | C-COVER |
| I216 | VIBRA MOTOR |
| I217 | MEMORY CARD DOOR |
| I218 | CLAPTON EMC MICROPHONE |
| I219 | CONN CHR DIA 2.0MM |
| I220 | C-SHIELD FOAM |
| I221 | SIM LID |
| I222 | C-COVER SHIELD |
| | |
| I223 | ANTENNA |
| I224 | SCREW M1.6X6.7 |
| I225 | BATTERY COVER ASSY |

## RM-178 component parts list

### Component parts list (1VA-02bb)

| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| A2000 | Top | I | 5 | SHIELD_040_012785 | RAP-WLAN SHIELD ASSEMBLY | ~ | ~ |
| A2102 | Top | E | 7 | PWB_1QD | PWB 1QD 10X4.6X1.5 | ~ | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| A2400 | Top | N | 6 | SHIELD_040_013002 | RETU-TAHVO AHIELD ASSEMBLY | ~ | ~ |
| A6100 | Bottom | R | 5 | SHIELD_040_008558 | FM RADIO ASSY 040-008558 P2348 | ~ | ~ |
| A7000 | Top | C | 5 | SHIELD_040_013089 | RF SHIELD ASSEMBLY | ~ | ~ |
| B2200 | Top | P | 6 | CRYSTAL_3.3X1.6_H0.9 | CRYSTAL 32.768KHZ +-30PPM 12.5PF | 32.768kHz | ~ |
| C2000 | Top | N | 8 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2001 | Top | N | 8 | 0603C_H0.95 | CHIPCAP X5R 470N K 25V 0603 | 470n | 25V |
| C2002 | Bottom | R | 4 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 | 6V3 |
| C2003 | Bottom | R | 4 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C2004 | Bottom | R | 4 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C2005 | Bottom | R | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2006 | Bottom | R | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2007 | Top | Q | 2 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2008 | Top | Q | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2009 | Top | Q | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2010 | Top | Q | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2011 | Bottom | R | 3 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2012 | Bottom | R | 3 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2013 | Bottom | R | 3 | 0402C | Chipcap 5% NP0 | 10p | 50V |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2014 | Bottom | R | 3 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2015 | Top | Q | 4 | 0402C | Chipcap 5% X7R | 270p | 50V |
| C2071 | Top | G | 3 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2072 | Top | P | 2 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2073 | Top | E | 5 | TANT_C_6.2X3.4_H1.7 | CHIPTCAP 150UM 10V 6X3.2X1.5 | 150u_10V | 10V |
| C2074 | Top | E | 2 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2100 | Top | Q | 2 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C2101 | Top | Q | 2 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C2102 | Top | Q | 2 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 | 6V3 |
| C2103 | Top | E | 8 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2104 | Top | E | 8 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2200 | Top | O | 5 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2201 | Top | P | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2202 | Top | P | 8 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2203 | Top | P | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2204 | Top | P | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2205 | Top | P | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2206 | Top | P | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2207 | Top | P | 7 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2208 | Top | Q | 6 | 0402C | Chipcap 5% NP0 | 27p | 50V |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2209 | Top | Q | 6 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2210 | Top | N | 7 | 0603C | CHIPCAP X5R 1U K 16V 0603 | 1u0 | 16V |
| C2211 | Top | N | 7 | 0805C | CHIPCAP X5R 4U7 K 10V 0805 | 4u7 | 10V |
| C2212 | Top | N | 6 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2213 | Top | O | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2214 | Top | O | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2215 | Top | O | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2216 | Top | O | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2217 | Top | P | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2218 | Top | P | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2219 | Top | P | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2220 | Top | N | 6 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2221 | Top | N | 8 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2222 | Top | N | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2223 | Top | O | 5 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2224 | Top | P | 5 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2225 | Top | P | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2226 | Top | O | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2227 | Top | N | 6 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2228 | Top | O | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2229 | Top | N | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2230 | Top | P | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2231 | Top | N | 5 | 0805C | CHIPCAP X5R 10U M 6V3 0805 | 10U | 6V3 |
| C2232 | Top | O | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2270 | Top | O | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2271 | Top | O | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2272 | Top | O | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2273 | Top | N | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2274 | Top | N | 6 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2275 | Top | N | 5 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2281 | Top | O | 8 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2300 | Top | M | 5 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2301 | Top | L | 5 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u | 6V3 |
| C2302 | Top | N | 5 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u | 6V3 |
| C2303 | Top | L | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2304 | Top | N | 6 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2305 | Top | L | 8 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2306 | Top | M | 4 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2307 | Top | L | 6 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2309 | Top | L | 5 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u | 6V3 |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2310 | Top | L | 6 | 0603C | CHIPCAP X5R 10UF 6V3 0603 | 10u | 4V |
| C2312 | Top | L | 6 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2313 | Top | L | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2314 | Top | M | 7 | 0805C | CHIPCAP X5R 4U7 M 25V 0805 | 4u7 | 25V |
| C2315 | Top | N | 8 | 0805C | CHIPCAP X5R 4U7 M 25V 0805 | 4u7 | 25V |
| C2316 | Top | N | 8 | 0402C | Chipcap 5% NP0 | 56p | 50V |
| C2317 | Top | N | 8 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2400 | Top | N | 4 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2401 | Top | N | 4 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2402 | Bottom | D | 8 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2403 | Bottom | C | 4 | 0402C | Chipcap 5% X7R | 1n0 | 50V |
| C2404 | Bottom | C | 5 | 0402C | Chipcap 5% X7R | 1n0 | 50V |
| C2406 | Bottom | C | 4 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2407 | Bottom | C | 4 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2408 | Bottom | C | 5 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2410 | Bottom | D | 4 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2411 | Bottom | D | 3 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2412 | Top | N | 6 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2413 | Bottom | D | 8 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2414 | Top | F | 4 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2600 | Top | K | 8 | 0805C | CHIPCAP X5R 4U7 M 25V 0805 | 4u7 | 25V |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2601 | Top | L | 8 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2602 | Top | L | 8 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C2700 | Top | Q | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C2800 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2801 | Top | F | 7 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2802 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2803 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2804 | Top | F | 7 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2805 | Top | F | 7 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2806 | Top | F | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2807 | Top | I | 5 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2808 | Top | G | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2809 | Top | G | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2810 | Top | I | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2811 | Top | F | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2812 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2813 | Top | F | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2814 | Top | G | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2816 | Top | I | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2819 | Top | I | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2820 | Top | F | 6 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2821 | Top | I | 7 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2822 | Top | F | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2823 | Top | I | 6 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2824 | Top | J | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2825 | Top | F | 7 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2826 | Top | I | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2828 | Top | I | 7 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2829 | Top | G | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2830 | Top | H | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2831 | Top | I | 7 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2832 | Top | G | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2833 | Top | I | 6 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3000 | Top | K | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3001 | Top | J | 5 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C3002 | Top | K | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3003 | Top | I | 8 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C3004 | Top | J | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3005 | Top | J | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3006 | Top | K | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3007 | Top | K | 8 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C3008 | Top | J | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3009 | Top | K | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3200 | Top | L | 2 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C3201 | Top | G | 2 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C3202 | Top | G | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C3203 | Top | H | 3 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C3204 | Top | L | 4 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C3205 | Top | G | 3 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C6031 | Top | I | 3 | 0402C | CHIPCAP N150 18P J 50V 0402 | 18p | 50V |
| C6032 | Top | J | 4 | 0402C | Chipcap 5% NP0 | 100p | 50V |
| C6033 | Top | J | 4 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C6034 | Top | J | 4 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C6035 | Top | J | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C6036 | Top | J | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C6037 | Top | J | 3 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C6038 | Top | I | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C6039 | Top | I | 4 | 0402C | CHIPCAP N150 18P J 50V 0402 | 18p | 50V |
| C6040 | Top | J | 3 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 | 6.3V |
| C6051 | Top | I | 3 | 0402C | Chipcap +-0.25pF NP0 | 2p7 | 50V |
| C6052 | Top | I | 3 | 0402C | Chipcap +-0.25pF NP0 | 2p7 | 50V |
| C6055 | Top | J | 4 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 | 6.3V |
| C6157 | Bottom | Q | 4 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C6158 | Bottom | Q | 4 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6159 | Bottom | R | 6 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C6162 | Bottom | R | 4 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C6163 | Bottom | R | 6 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C6164 | Bottom | R | 5 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6165 | Bottom | R | 6 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C6168 | Bottom | Q | 6 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6170 | Bottom | Q | 5 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C6176 | Bottom | R | 6 | 0402C | Chipcap 5% NP0 | 100p | 50V |
| C6178 | Bottom | Q | 6 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C6179 | Bottom | Q | 5 | 0402C | Chipcap 5% NP0 | 47p | 50V |
| C6188 | Bottom | Q | 6 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6189 | Bottom | R | 6 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6190 | Top | Q | 5 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6191 | Top | Q | 5 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C7501 | Top | C | 4 | 0402C | Chipcap +-0.25pF NP0 | 2p7 | 50V |
| C7502 | Top | D | 4 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C7503 | Top | D | 3 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C7504 | Top | B | 4 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C7505 | Top | D | 3 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 | 6.3V |
| C7506 | Top | D | 3 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C7507 | Top | D | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C7508 | Top | D | 3 | 0402C | Chipcap 5% NP0 | 18p | 50V |
| C7509 | Top | D | 3 | 0402C | Chipcap +-0.25pF NP0 | 2p7 | 50V |
| C7510 | Top | D | 4 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C7511 | Top | C | 3 | 0603C | CHIPCAP NP0 2N2 G 16V 0603 | 2n2 | 16V |
| C7513 | Top | D | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C7515 | Top | B | 3 | 0402C | Chipcap +-0.25pF NP0 | 4p7 | 50V |
| C7516 | Top | C | 3 | 0402C | CHIPCAP NP0 470P J 6V3 0402 | 470p | 6V3 |
| C7518 | Top | D | 4 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C7520 | Top | C | 7 | 0402C | Chipcap +-0.25pF NP0 | 3p3 | 50V |
| C7522 | Top | D | 6 | 0402C | Chipcap +-0.25pF NP0 | 1p8 | 50V |
| C7524 | Top | D | 6 | 0402C | Chipcap +-0.25pF NP0 | 1p8 | 50V |
| C7525 | Top | D | 8 | 0402C | Chipcap 5% NP0 | 18p | 50V |
| C7590 | Top | K | 1 | 0402C | Chipcap 5% NP0 | 100p | 50V |
| C7592 | Top | J | 1 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| D2200 | Top | O | 6 | TFBGA_108 | RETU 3.02 TSA1GJWE TFBGA108 | ~ | ~ |
| D2800 | Top | H | 6 | uBGA_289 | RAPGSM V1.1 PA uBGA289 | ~ | ~ |
| D3000 | Top | J | 6 | FBGA133_11.1X10.1 | COMBO 256M NOR + 128M DDR DRAM FBGA133 | 256MNOR +128MDDR | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| F2000 | Top | P | 8 | 0603_FUSE_AVX2MATS | SM FUSE F 2.0A 32V | 2A | ~ |
| F2400 | Bottom | D | 5 | 0402_FUSE_AVX_H0.5 | FUSE F 0.75A 32V 0402 | 0.75A | ~ |
| G2200 | Top | G | 4 | BATTER_EECEP | RTC BACUP CAPAC 311 SIZE FOR 2.6V 4UAH | 2.6V | ~ |
| G7500 | Top | C | 3 | VCO_DCS02733 | VCO 3296-3980MHZ 4-BAND MATSUSHITA | 3296-3980MHz | ~ |
| G7501 | Top | D | 2 | NKG3176B_H1.0 | VCTCXO 38.4MHZ 2.5V | 38.4MHz | ~ |
| L2000 | Top | O | 8 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2001 | Bottom | Q | 3 | 0405_2_H1.0 | CHIP BEAD ARRAY 2X1000R 0405 | 2x1000R/ 100MHz | ~ |
| L2002 | Bottom | Q | 3 | 0405_2_H1.0 | CHIP BEAD ARRAY 2X1000R 0405 | 2x1000R/ 100MHz | ~ |
| L2003 | Bottom | R | 3 | 0405_2_H1.0 | CHIP BEAD ARRAY 2X1000R 0405 | 2x1000R/ 100MHz | ~ |
| L2004 | Bottom | R | 3 | COIL_LK_1608 | CHIP COIL 68NH J Q12/100MHZ 0603 | 68nH | ~ |
| L2202 | Top | P | 8 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2203 | Top | O | 8 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |
| L2204 | Top | P | 8 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |
| L2205 | Top | P | 8 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2206 | Top | O | 7 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| L2211 | Top | N | 5 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2212 | Top | N | 6 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2270 | Top | O | 5 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2271 | Top | O | 5 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2301 | Top | L | 5 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2302 | Top | M | 5 | CHOKE_SER400_H1.2 | INDUCT WW 10UH 0A65 0R35 4X4X1.2 | 10uH | ~ |
| L2304 | Top | M | 7 | CHOKE_SER300_H1.5 | CHOKE 22U M 0R7 0.35A 3.0x3.0x1.5 | 22uH | ~ |
| L2305 | Top | L | 7 | 0603_BLM | FERRITE BEAD 0R5 600R/ 100MHZ 0603 | 600R/ 100MHz | ~ |
| L2306 | Top | M | 4 | 0603_BLM | FERRITE BEAD 0R5 600R/ 100MHZ 0603 | 600R/ 100MHz | ~ |
| L2401 | Bottom | C | 3 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |
| L2402 | Bottom | C | 4 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |
| L2403 | Bottom | C | 5 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |
| L2404 | Bottom | D | 7 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |
| L2405 | Bottom | C | 5 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| L2406 | Bottom | D | 5 | 0402L | FERRITE BEAD 0.6R 33R/ 100MHZ 0402 | 33R/100MHZ | ~ |
| L2407 | Bottom | D | 5 | 0402L | FERRITE BEAD 0.6R 33R/ 100MHZ 0402 | 33R/100MHZ | ~ |
| L2408 | Bottom | D | 5 | 0402L | FERRITE BEAD 0.6R 33R/ 100MHZ 0402 | 33R/100MHZ | ~ |
| L2409 | Bottom | D | 5 | 0402L | FERRITE BEAD 0.6R 33R/ 100MHZ 0402 | 33R/100MHZ | ~ |
| L3200 | Top | L | 2 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |
| L6030 | Top | I | 3 | 0402L | CHIP COIL 2N7 +-0N3 Q29/800M 0402 | 2n7H | ~ |
| L6031 | Top | I | 3 | 0402L | CHIP COIL 2N7 +-0N3 Q29/800M 0402 | 2n7H | ~ |
| L6032 | Top | J | 3 | 0402L | CHIP COIL 22N J Q28/800M 0402 | 22nH | ~ |
| L6156 | Bottom | R | 5 | COIL_0603CS | CHIP COIL 47N G Q38/200MHZ 0603 | 47nH | ~ |
| L6176 | Bottom | Q | 6 | COIL_LQW160 8 | CHIP COIL 120N J Q32/150MHZ 0603 | 120nH | ~ |
| L7500 | Top | C | 5 | 0402L | CHIP COIL 12N J Q31/800M 0402 | 12nH | ~ |
| L7501 | Top | C | 5 | 0402L | CHIP COIL 12N J Q31/800M 0402 | 12nH | ~ |
| L7502 | Top | D | 4 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |
| L7504 | Top | C | 5 | 0402L | CHIP COIL 22N J Q28/800M 0402 | 22nH | ~ |
| L7505 | Top | C | 5 | 0402L | CHIP COIL 22N J Q28/800M 0402 | 22nH | ~ |
| L7515 | Top | C | 3 | 0402L | CHIP COIL 15N J Q30/800M 0402 | 15nH | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| N2300 | Top | M | 6 | TFBGA_84_6.15X6.15 | TAHVO V5.2 LF TFBGA84 | ~ | ~ |
| N2301 | Top | M | 8 | USMD8_1.69X1.69 | WHITE LED DRIVER 4LEDS 500MW 8BUMP USMD8 | ~ | ~ |
| N2302 | Top | N | 7 | SOT_666 | TRX2+RX4 PEMD9 N&P 10K/47K 0W12 SOT666 | ~ | ~ |
| N2401 | Bottom | E | 8 | SH248CSP | HALL IC SWITCH SH248CSP VCC | ~ | ~ |
| N2600 | Top | M | 8 | IRDA_TFBS_GP2W_CIM | IRDA MIR XSMALL | ~ | ~ |
| N3200 | Top | G | 3 | USMD16_2.03X2.03 | VREG & LEVEL SHIFT LP3928 USMD16 | ~ | 2.8V |
| N6030 | Top | J | 3 | CSP_47_3.85X4.05 | BC4-ROM1.0RDL | ~ | ~ |
| N6156 | Bottom | R | 5 | WFBGA34_2_3.57X3.57 | FM RECEIVER TEA5761UK N3D CSP (TI) | ~ | ~ |
| N7505 | Top | C | 4 | TFBGA144 | RFIC AHNE400A TRANSCEIVER TFBGA144 | ~ | ~ |
| N7520 | Top | D | 7 | RF9282E3.6 | PA RF9282E6.3 GSM/EDGE 850/900/1800/1900 | ~ | ~ |
| R2000 | Bottom | Q | 4 | 0402R | Resistor 5% 63mW | 220R | ~ |
| R2001 | Bottom | Q | 4 | uBGA11_2.15X1.65 | ASIP MIC W/ESD RES+CAP+ZDI BGA11 | ~ | ~ |
| R2002 | Top | Q | 3 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R2003 | Top | Q | 3 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R2004 | Top | Q | 2 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R2005 | Top | Q | 3 | 0402R | Resistor 5% 63mW | 10R | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| R2006 | Bottom | Q | 3 | uBGA5 | ASIP 4XESD **PB-FREE** BGA5 | ~ | ~ |
| R2007 | Top | Q | 4 | uBGA11_1.6X 2.15 | ASIP SILIC USB OTG / ESD BGA11 | ~ | ~ |
| R2008 | Top | Q | 4 | 0404_RP | RES NETWORK 0W06 220K/ 120K J 0404 | 220k/120k | ~ |
| R2009 | Top | Q | 4 | 0402R | Resistor 5% 63mW | 220R | ~ |
| R2070 | Top | P | 2 | 0402_NTH5 | NTC RES 47K J B=4050+-3% 0402 | 47k | ~ |
| R2071 | Top | G | 3 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/50V | ~ |
| R2100 | Top | Q | 2 | FLIP_CHIP_8_ 1.7X1.7 | ASIP SINGLE ENDED MICROPHONE INTERF BGA8 | ~ | ~ |
| R2101 | Top | P | 2 | 0402R | Resistor 5% 63mW | 220R | ~ |
| R2200 | Top | P | 8 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R2201 | Top | P | 7 | 0402R | Resistor 5% 63mW | 120k | ~ |
| R2202 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2203 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2204 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2205 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2206 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2207 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2208 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2209 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| R2212 | Top | O | 5 | 0402R | Resistor 5% 63mW | 470R | ~ |
| R2213 | Top | P | 7 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R2214 | Top | P | 8 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R2216 | Top | Q | 7 | 0402R | CHIPRES 0W06 2M2 J 0402 | 2M2 | ~ |
| R2301 | Top | N | 7 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R2307 | Top | L | 4 | 0402R | Resistor 5% 63mW | 100R | ~ |
| R2400 | Top | O | 4 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R2401 | Top | O | 4 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R2402 | Bottom | D | 8 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R2403 | Top | N | 6 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R2404 | Top | G | 1 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/50V | ~ |
| R2405 | Top | F | 5 | 0402R | Resistor 5% 63mW | 47R | ~ |
| R2406 | Bottom | O | 6 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/50V | ~ |
| R2407 | Bottom | O | 3 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/50V | ~ |
| R2410 | Bottom | Q | 1 | 0402R | Resistor 5% 63mW | 120R | ~ |
| R2600 | Top | K | 8 | 0805R_THERM1 | CHIPRES 0W125 4R7 J 0805 | 4R7 | ~ |
| R2700 | Top | Q | 4 | uBGA8_1.47X1.47 | ASIP SIM INTERFACE **LOW CAP**BGA8 | ~ | ~ |
| R2701 | Bottom | D | 3 | 0402R | Resistor 5% 63mW | 1k0 | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| R2702 | Bottom | D | 3 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2803 | Top | I | 8 | 0402R | Resistor 5% 63mW | 100R | ~ |
| R2804 | Top | H | 8 | 0402R | Resistor 5% 63mW | 100R | ~ |
| R2806 | Top | F | 6 | 0402R | Resistor 5% 63mW | 68k | ~ |
| R3000 | Top | J | 5 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R3002 | Top | H | 8 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R3003 | Top | I | 8 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R3004 | Top | K | 7 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R3200 | Top | L | 1 | uBGA11_1.62 X2.12 | ASIP EMIF04-MMC02F2**PB-FREE** | ~ | ~ |
| R3201 | Top | G | 4 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R3202 | Top | G | 3 | 0402R | Resistor 5% 63mW | 22k | ~ |
| R3203 | Top | K | 5 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R3204 | Top | L | 4 | 0402R | Resistor 5% 63mW | 2k2 | ~ |
| R3205 | Top | G | 3 | 0402R | CHIPRES 0W06 33R F 100PPM 0402 | 33R | ~ |
| R3206 | Top | G | 4 | 0402R | CHIPRES 0W06 33R F 100PPM 0402 | 33R | ~ |
| R6030 | Top | J | 4 | 0402R | Resistor 5% 63mW | 10k | ~ |
| R6031 | Top | I | 3 | 0402R | Resistor 5% 63mW | 10k | ~ |
| R6032 | Top | J | 3 | 0402R | CHIPRES 0W06 2R2 J 0402 | 2R2 | ~ |
| R6034 | Top | I | 4 | 0402R | Resistor 5% 63mW | 10k | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| R6156 | Bottom | R | 5 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R6157 | Bottom | Q | 6 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R6159 | Bottom | Q | 5 | 0402R | Resistor 5% 63mW | 10k | ~ |
| R6160 | Bottom | Q | 5 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R6300 | Top | I | 3 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R7501 | Top | C | 3 | 0402R | Resistor 5% 63mW | 2k2 | ~ |
| R7502 | Top | B | 4 | 0402R | CHIPRES 0W06 10K F 0402 | 10k | ~ |
| R7503 | Top | D | 4 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R7505 | Top | C | 3 | 0402R | CHIPRES 0W06 8K2 F 0402 | 8k2 | ~ |
| R7506 | Top | D | 3 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R7507 | Top | B | 4 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R7508 | Top | D | 3 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R7509 | Top | D | 3 | 0402R | Resistor 5% 63mW | 22k | ~ |
| R7510 | Top | D | 7 | 0402R | Resistor 5% 63mW | 15R | ~ |
| R7522 | Top | D | 7 | 0402R | CHIPRES 0W06 27K F 0402 | 27k | ~ |
| R7590 | Top | K | 1 | 0402R | Resistor 5% 63mW | 22k | ~ |
| R7591 | Top | K | 1 | 0402R | Resistor 5% 63mW | 68k | ~ |
| R7592 | Top | K | 2 | 0402R | Resistor 5% 63mW | 1k5 | ~ |
| R7593 | Top | J | 1 | 0402R | Chipres 0W06 jumper 0402 | 0R | ~ |
| S2416 | Top | E | 8 | SWITCH_EVQ5 P701K | SM SW TACT SPST 12V SIDE KEY 3N | ~ | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| S2417 | Top | H | 8 | SWITCH_EVQ5P701K | SM SW TACT SPST 12V SIDE KEY 3N | ~ | ~ |
| S3200 | Top | O | 1 | SWITCH_SPVM110201 | SWITCH SPST NO 5V 1MA | ~ | ~ |
| T7501 | Top | C | 2 | TRANS_LDB15 | TRANSF BALUN 3800+-550MHZ 0805 | ~ | ~ |
| T7520 | Top | C | 7 | TRANS_LDB15 | TRANSF BALUN 1800+-100mhz 2x1.25 | ~ | ~ |
| V2000 | Top | O | 8 | BGA4_1.01X1.07 | ASIP TVS BGA4 | ~ | ~ |
| V2302 | Top | L | 4 | SOD323F | SCH DI 30V 2A SOD323F | ~ | ~ |
| V2400 | Bottom | O | 6 | LED_LWV18G | LED BLUE 11-53MCD 5MA 90DEG 0603 | ~ | ~ |
| V2401 | Bottom | I | 6 | LED_LWV18G | LED BLUE 11-53MCD 5MA 90DEG 0603 | ~ | ~ |
| V2402 | Bottom | I | 3 | LED_LWV18G | LED BLUE 11-53MCD 5MA 90DEG 0603 | ~ | ~ |
| V2403 | Bottom | O | 3 | LED_LWV18G | LED BLUE 11-53MCD 5MA 90DEG 0603 | ~ | ~ |
| V7590 | Top | K | 1 | SOT323 | Tr NPN 12V 35mA SOT323 | ~ | ~ |
| X2000 | Top | R | 4 | SYSCON_MQ202_NK_14R3 | SM SYSTEM CONNECTOR 14POL | ~ | ~ |
| X2060 | Bottom | B | 5 | TRACEABILITY_PAD | MODULE ID COMPONENT 2.8X1.8X0.3 | ~ | ~ |
| X2070 | Top | F | 3 | LYNX_BATT_CONN_H7.0 | SM BATTERY CONN 3POL SPR 12V 2A | ~ | ~ |
| X2400 | Bottom | D | 4 | CON_DF30FC_50DS_0.4V | CONN BTB 2X25F P0.4 30V 0.3A | ~ | ~ |
| X2401 | Top | G | 1 | SWITCH_EVQP4003M | SWITCH TACT SPST 15V 20MA HARD KNOB | ~ | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| X2701 | Top | P | 3 | SIM_CONN_470192001 | SM SIM CONN 6POL P2.54 | ~ | ~ |
| X3200 | Top | M | 2 | MOLEX_500873_0801 | CONN TRF/ MICROSD 12POL P0.5 10V | ~ | ~ |
| X7505 | Top | B | 8 | RF_SWITCH_MS_156 | SM CONN RF JACK 50R 2W 6GHZ | ~ | ~ |
| Z2000 | Top | Q | 5 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |
| Z2001 | Top | Q | 4 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |
| Z2003 | Top | Q | 5 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/ 100MHZ 0402 | 600R/ 100MHz | ~ |
| Z2400 | Bottom | D | 6 | uBGA25_2.47X2.47 | ASIP 10-CH ESD EMI FILTER BGA25 | ~ | ~ |
| Z2403 | Bottom | B | 4 | uBGA25_2.47X2.47 | ASIP 10-CH ESD EMI FILTER BGA25 | ~ | ~ |
| Z2404 | Bottom | C | 3 | uBGA25_2.47X2.47 | ASIP 10-CH ESD EMI FILTER BGA25 | ~ | ~ |
| Z6030 | Top | I | 3 | EZFVQ42NM61S | LTCC FILT 2441.75 +-41.75MHZ 2.5X2 | 2441.75MHz | ~ |
| Z6302 | Top | E | 1 | ANTENNA_NAN68_PC0400C | ANTENNA INT WLAN P2636 (3-PAD) | ~ | ~ |
| Z7501 | Top | C | 6 | FILTER_2.1X1.7_10P_H0.65 | DUAL RX SAW FILTER 1800/1900MHZ 2016 | 1800/1900MHz | ~ |
| Z7503 | Top | D | 5 | MODULE_SP_LMZ_137 | TX SAW MODULE GSM 850/900MHZ 4.5X3.2 | 850/900MHz | ~ |
| Z7504 | Top | C | 6 | FILTER_2.1X1.7_10P_H0.65 | DUAL RX SAW FILTER 850/900MHZ 2016 | 850/900MHz | ~ |


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| Item | Side | Grid | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| Z7520 | Top | B | 6 | FERRITE_FBMJ 1608 | FERRITE BEAD 0R01 28R/ 100MHZ 0603 | 28R/100MHz | ~ |
| Z7521 | Top | C | 7 | FILTER_LFTC10N | CER FILT LFL181699TC1 2400-2480MHZ 1.6 | 2400-2483MHz | ~ |

## RM-106/199 component parts list

### Component parts list (1PF-05bb)

| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| A2000 | Top | I | 5 | SHIELD_040_012785 | RAP-WLAN SHIELD ASSEMBLY | ~ | ~ |
| A2102 | Top | E | 7 | PWB_1QD | PWB 1QD 10X4.6X1.5 | ~ | ~ |
| A2400 | Top | N | 6 | SHIELD_040_013002 | RETU-TAHVO AHIELD ASSEMBLY | ~ | ~ |
| A6100 | Bottom | R | 5 | SHIELD_040_008558 | FM RADIO ASSY 040-008558 P2348 | ~ | ~ |
| A7000 | Top | C | 5 | SHIELD_040_013089 | RF SHIELD ASSEMBLY | ~ | ~ |
| B2200 | Top | P | 6 | CRYSTAL_3.3X1.6_H0.9 | CRYSTAL 32.768KHZ +-30PPM 12.5PF | 32.768kHz | ~ |
| C2000 | Top | N | 8 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2001 | Top | N | 8 | 0603C_H0.95 | CHIPCAP X5R 470N K 25V 0603 | 470n | 25V |
| C2002 | Bottom | R | 4 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 | 6V3 |
| C2003 | Bottom | R | 4 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C2004 | Bottom | R | 4 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C2005 | Bottom | R | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2006 | Bottom | R | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2007 | Top | Q | 2 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2008 | Top | Q | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2009 | Top | Q | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2010 | Top | Q | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2011 | Botto m | R | 3 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2012 | Botto m | R | 3 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2013 | Botto m | R | 3 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2014 | Botto m | R | 3 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2015 | Top | Q | 4 | 0402C | Chipcap 5% X7R | 270p | 50V |
| C2071 | Top | G | 3 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2072 | Top | P | 2 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2073 | Top | E | 5 | TANT_C_6.2X3.4_ H1.7 | CHIPTCAP 150U M 10V 6X3.2X1.5 | 150u_10V | 10V |
| C2074 | Top | E | 2 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2100 | Top | Q | 2 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C2101 | Top | Q | 2 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C2102 | Top | Q | 2 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 | 6V3 |
| C2103 | Top | E | 8 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2104 | Top | E | 8 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C2200 | Top | O | 5 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2201 | Top | P | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2202 | Top | P | 8 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2203 | Top | P | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2204 | Top | P | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2205 | Top | P | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2206 | Top | P | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2207 | Top | P | 7 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2208 | Top | Q | 6 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2209 | Top | Q | 6 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2210 | Top | N | 7 | 0603C | CHIPCAP X5R 1U K 16V 0603 | 1u0 | 16V |
| C2211 | Top | N | 7 | 0805C | CHIPCAP X5R 4U7 K 10V 0805 | 4u7 | 10V |
| C2212 | Top | N | 6 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2213 | Top | O | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2214 | Top | O | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2215 | Top | O | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2216 | Top | O | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2217 | Top | P | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2218 | Top | P | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2219 | Top | P | 7 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2220 | Top | N | 6 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C2221 | Top | N | 8 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2222 | Top | N | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2223 | Top | O | 5 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2224 | Top | P | 5 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2225 | Top | P | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2226 | Top | O | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2227 | Top | N | 6 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2228 | Top | O | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2229 | Top | N | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2230 | Top | P | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2231 | Top | N | 5 | 0805C | CHIPCAP X5R 10U M 6V3 0805 | 10U | 6V3 |
| C2232 | Top | O | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2270 | Top | O | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2271 | Top | O | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2272 | Top | O | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2273 | Top | N | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2274 | Top | N | 6 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2275 | Top | N | 5 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2281 | Top | O | 8 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2300 | Top | M | 5 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2301 | Top | L | 5 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u | 6V3 |
| C2302 | Top | N | 5 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u | 6V3 |
| C2303 | Top | L | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2304 | Top | N | 6 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2305 | Top | L | 8 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2306 | Top | M | 4 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2307 | Top | L | 6 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2309 | Top | L | 5 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u | 6V3 |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2310 | Top | L | 6 | 0603C | CHIPCAP X5R 10UF 6V3 0603 | 10u | 4V |
| C2312 | Top | L | 6 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2313 | Top | L | 7 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2314 | Top | M | 7 | 0805C | CHIPCAP X5R 4U7 M 25V 0805 | 4u7 | 25V |
| C2315 | Top | N | 8 | 0805C | CHIPCAP X5R 4U7 M 25V 0805 | 4u7 | 25V |
| C2316 | Top | N | 8 | 0402C | Chipcap 5% NP0 | 56p | 50V |
| C2317 | Top | N | 8 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2400 | Top | N | 4 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2401 | Top | N | 4 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2402 | Bottom | D | 8 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2403 | Bottom | C | 4 | 0402C | Chipcap 5% X7R | 1n0 | 50V |
| C2404 | Bottom | C | 5 | 0402C | Chipcap 5% X7R | 1n0 | 50V |
| C2406 | Bottom | C | 4 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2407 | Bottom | C | 4 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2408 | Bottom | C | 5 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2410 | Bottom | D | 4 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2411 | Bottom | D | 3 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2412 | Top | N | 6 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2413 | Bottom | D | 8 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C2414 | Top | F | 4 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2600 | Top | K | 8 | 0805C | CHIPCAP X5R 4U7 M 25V 0805 | 4u7 | 25V |
| C2601 | Top | L | 8 | 0402C | Chipcap 5% NP0 | 22p | 50V |
| C2602 | Top | L | 8 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2700 | Top | Q | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C2800 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2801 | Top | F | 7 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2802 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2803 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2804 | Top | F | 7 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2805 | Top | F | 7 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2806 | Top | F | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2807 | Top | I | 5 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C2808 | Top | G | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2809 | Top | G | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2810 | Top | I | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2811 | Top | F | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2812 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2813 | Top | F | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2814 | Top | G | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2816 | Top | I | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2819 | Top | I | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2820 | Top | F | 6 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2821 | Top | I | 7 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C2822 | Top | F | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2823 | Top | I | 6 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2824 | Top | J | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2825 | Top | F | 7 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C2826 | Top | I | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2828 | Top | I | 7 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2829 | Top | G | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2830 | Top | H | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2831 | Top | I | 7 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C2832 | Top | G | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C2833 | Top | I | 6 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3000 | Top | K | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3001 | Top | J | 5 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C3002 | Top | K | 5 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3003 | Top | I | 8 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C3004 | Top | J | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3005 | Top | J | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3006 | Top | K | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3007 | Top | K | 8 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C3008 | Top | J | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |
| C3009 | Top | K | 8 | 0402C_H0.6 | CHIPCAP X5R 100N M 16V 0402 | 100n | 16V |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C3200 | Top | L | 2 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C3201 | Top | G | 2 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C3202 | Top | G | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C3203 | Top | H | 3 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C3204 | Top | L | 4 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C3205 | Top | G | 3 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C6157 | Botto m | Q | 4 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C6158 | Botto m | Q | 4 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6159 | Botto m | R | 6 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C6162 | Botto m | R | 4 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C6163 | Botto m | R | 6 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C6164 | Botto m | R | 5 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6165 | Botto m | R | 6 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C6168 | Botto m | Q | 6 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6170 | Botto m | Q | 5 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C6176 | Botto m | R | 6 | 0402C | Chipcap 5% NP0 | 100p | 50V |
| C6178 | Botto m | Q | 6 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C6179 | Botto m | Q | 5 | 0402C | Chipcap 5% NP0 | 47p | 50V |
| C6188 | Botto m | Q | 6 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6189 | Botto m | R | 6 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6190 | Top | Q | 5 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C6191 | Top | Q | 5 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6300 | Top | K | 2 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u | 6V3 |
| C6301 | Top | K | 4 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C6302 | Top | K | 3 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 | 6V3 |
| C6303 | Top | K | 4 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C6304 | Top | J | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6305 | Top | K | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6307 | Top | J | 3 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 | 6.3V |
| C6308 | Top | I | 4 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6309 | Top | H | 4 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C6310 | Top | H | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6311 | Top | H | 4 | 0402C | chipcap x7r 47n k 10v 0402 | 47n | 10V |
| C6312 | Top | H | 3 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6313 | Top | H | 4 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6314 | Top | I | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6315 | Top | I | 4 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6317 | Top | I | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6318 | Top | I | 4 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6319 | Top | I | 3 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6320 | Top | J | 4 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C6321 | Top | I | 3 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6322 | Top | K | 3 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6323 | Top | J | 3 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6324 | Top | J | 3 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6325 | Top | J | 4 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6326 | Top | J | 3 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6327 | Top | J | 4 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C6330 | Top | J | 1 | 0603C | CHIPCAP X5R 4U7 K 6V3 0603 | 4u7 | 6.3V |
| C6335 | Top | I | 2 | 0402C | CHIPCAP NP0 220P J 25V 0402 | 220p | 25V |
| C6338 | Top | I | 1 | 0402C | Chipcap 5% NP0 | 47p | 50V |
| C6340 | Top | I | 1 | 0402C | Chipcap +-0.25pF NP0 | 6p8 | 50V |
| C6341 | Top | I | 3 | 0402C | Chipcap 5% NP0 | 100p | 50V |
| C6344 | Top | H | 4 | 0402C | Chipcap +-0.25pF NP0 | 2p7 | 50V |
| C6345 | Top | H | 3 | 0402C | Chipcap +-0.25pF NP0 | 2p7 | 50V |
| C6346 | Top | J | 4 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6347 | Top | J | 4 | 0402C | Chipcap 5% NP0 | 82p | 50V |
| C6348 | Top | I | 4 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 | 6.3V |
| C6351 | Top | K | 4 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 | 50V |
| C6352 | Top | I | 4 | 0402C | Chipcap 5% NP0 | 150p | 50V |
| C6357 | Top | H | 3 | 0402C | CHIPCAP NP0 220P J 25V 0402 | 220p | 25V |
| C6360 | Top | H | 4 | 0402C | CHIPCAP NP0 220P J 25V 0402 | 220p | 25V |
| C6397 | Top | H | 3 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 | 4V |
| C6398 | Top | J | 2 | 0402C | Chipcap +-0.25pF NP0 | 6p8 | 50V |
| C6399 | Top | I | 2 | 0402C | Chipcap +-0.25pF NP0 | 6p8 | 50V |
| C7501 | Top | C | 4 | 0402C | Chipcap +-0.25pF NP0 | 2p7 | 50V |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| C7502 | Top | D | 4 | 0402C | Chipcap 5% NP0 | 10p | 50V |
| C7503 | Top | D | 3 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C7504 | Top | B | 4 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C7505 | Top | D | 3 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 | 6.3V |
| C7506 | Top | D | 3 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 | 6.3V |
| C7507 | Top | D | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C7508 | Top | D | 3 | 0402C | Chipcap 5% NP0 | 18p | 50V |
| C7509 | Top | D | 3 | 0402C | Chipcap +-0.25pF NP0 | 2p7 | 50V |
| C7510 | Top | D | 4 | 0402C | Chipcap 5% NP0 | 27p | 50V |
| C7511 | Top | C | 3 | 0603C | CHIPCAP NP0 2N2 G 16V 0603 | 2n2 | 16V |
| C7513 | Top | D | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n | 16V |
| C7514 | Top | D | 3 | 0402C | CHIPCAP X7R 33N K 10V 0402 | 33n | 10V |
| C7515 | Top | B | 3 | 0402C | Chipcap +-0.25pF NP0 | 4p7 | 50V |
| C7516 | Top | C | 3 | 0402C | CHIPCAP NP0 470P J 6V3 0402 | 470p | 6V3 |
| C7518 | Top | D | 4 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| C7520 | Top | C | 7 | 0402C | Chipcap +-0.25pF NP0 | 3p3 | 50V |
| C7522 | Top | D | 6 | 0402C | Chipcap +-0.25pF NP0 | 1p8 | 50V |
| C7524 | Top | D | 6 | 0402C | Chipcap +-0.25pF NP0 | 1p8 | 50V |
| C7525 | Top | D | 8 | 0402C | Chipcap 5% NP0 | 18p | 50V |
| C7590 | Top | K | 1 | 0402C | Chipcap 5% NP0 | 100p | 50V |
| C7592 | Top | J | 1 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n | 10V |
| D2200 | Top | O | 6 | TFBGA_108 | RETU 3.02 TSA1GJWE TFBGA108 | ~ | ~ |
| D2800 | Top | H | 6 | uBGA_289 | RAPGSM V1.1 PA uBGA289 | ~ | ~ |
| D3000 | Top | J | 6 | FBGA133_11.1X10.1 | COMBO 256M NOR + 128M DDR DRAM FBGA133 | 256MNOR +128MDDR | ~ |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| F2000 | Top | P | 8 | 0603_FUSE_AVX2 MATS | SM FUSE F 2.0A 32V | 2A | ~ |
| F2400 | Botto m | D | 5 | 0402_FUSE_AVX_ H0.5 | FUSE F 0.75A 32V 0402 | 0.75A | ~ |
| G2200 | Top | G | 4 | BATTER_EECEP | RTC BACUP CAPAC 311 SIZE FOR 2.6V 4UAH | 2.6V | ~ |
| G7500 | Top | C | 3 | VCO_DCS02733 | VCO 3296-3980MHZ 4-BAND MATSUSHITA | 3296-3980 MHz | ~ |
| G7501 | Top | D | 2 | NKG3176B_H1.0 | VCTCXO 38.4MHZ 2.5V | 38.4MHz | ~ |
| L2000 | Top | O | 8 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2001 | Botto m | Q | 3 | 0405_2_H1.0 | CHIP BEAD ARRAY 2X1000R 0405 | 2x1000R/ 100MHz | ~ |
| L2002 | Botto m | Q | 3 | 0405_2_H1.0 | CHIP BEAD ARRAY 2X1000R 0405 | 2x1000R/ 100MHz | ~ |
| L2003 | Botto m | R | 3 | 0405_2_H1.0 | CHIP BEAD ARRAY 2X1000R 0405 | 2x1000R/ 100MHz | ~ |
| L2004 | Botto m | R | 3 | COIL_LK_1608 | CHIP COIL 68NH J Q12/100MHZ 0603 | 68nH | ~ |
| L2202 | Top | P | 8 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2203 | Top | O | 8 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/ 100MHz | ~ |
| L2204 | Top | P | 8 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/ 100MHz | ~ |
| L2205 | Top | P | 8 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2206 | Top | O | 7 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/ 100MHz | ~ |
| L2211 | Top | N | 5 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2212 | Top | N | 6 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2270 | Top | O | 5 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2271 | Top | O | 5 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2301 | Top | L | 5 | 0603_BLM | FERR.BEAD 220R/100M 2A 0R05 0603 | 220R/ 100MHz | ~ |
| L2302 | Top | M | 5 | CHOKE_SER400_ H1.2 | INDUCT WW 10UH 0A65 0R35 4X4X1.2 | 10uH | ~ |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| L2304 | Top | M | 7 | CHOKE_SER300_H1.5 | CHOKE 22U M 0R7 0.35A 3.0x3.0x1.5 | 22uH | ~ |
| L2305 | Top | L | 7 | 0603_BLM | FERRITE BEAD 0R5 600R/100MHZ 0603 | 600R/100MHz | ~ |
| L2306 | Top | M | 4 | 0603_BLM | FERRITE BEAD 0R5 600R/100MHZ 0603 | 600R/100MHz | ~ |
| L2401 | Bottom | C | 3 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/100MHz | ~ |
| L2402 | Bottom | C | 4 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/100MHz | ~ |
| L2403 | Bottom | C | 5 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/100MHz | ~ |
| L2404 | Bottom | D | 7 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/100MHz | ~ |
| L2405 | Bottom | C | 5 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/100MHz | ~ |
| L2406 | Bottom | D | 5 | 0402L | FERRITE BEAD 0.6R 33R/100MHZ 0402 | 33R/100MHZ | ~ |
| L2407 | Bottom | D | 5 | 0402L | FERRITE BEAD 0.6R 33R/100MHZ 0402 | 33R/100MHZ | ~ |
| L2408 | Bottom | D | 5 | 0402L | FERRITE BEAD 0.6R 33R/100MHZ 0402 | 33R/100MHZ | ~ |
| L2409 | Bottom | D | 5 | 0402L | FERRITE BEAD 0.6R 33R/100MHZ 0402 | 33R/100MHZ | ~ |
| L3200 | Top | L | 2 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/100MHz | ~ |
| L6156 | Bottom | R | 5 | COIL_0603CS | CHIP COIL 47N G Q38/200MHZ 0603 | 47nH | ~ |
| L6176 | Bottom | Q | 6 | COIL_LQW1608 | CHIP COIL 120N J Q32/150MHZ 0603 | 120nH | ~ |
| L7500 | Top | C | 5 | 0402L | CHIP COIL 12N J Q31/800M 0402 | 12nH | ~ |
| L7501 | Top | C | 5 | 0402L | CHIP COIL 12N J Q31/800M 0402 | 12nH | ~ |
| L7502 | Top | D | 4 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/100MHz | ~ |
| L7504 | Top | C | 5 | 0402L | CHIP COIL 22N J Q28/800M 0402 | 22nH | ~ |
| L7505 | Top | C | 5 | 0402L | CHIP COIL 22N J Q28/800M 0402 | 22nH | ~ |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| L7515 | Top | C | 3 | 0402L | CHIP COIL 15N J Q30/800M 0402 | 15nH | ~ |
| N2300 | Top | M | 6 | TFBGA_84_6.15X6.15 | TAHVO V5.2 LF TFBGA84 | ~ | ~ |
| N2301 | Top | M | 8 | USMD8_1.69X1.69 | WHITE LED DRIVER 4LEDS 500MW 8BUMP USMD8 | ~ | ~ |
| N2302 | Top | N | 7 | SOT_666 | TRX2+RX4 PEMD9 N&P 10K/47K 0W12 SOT666 | ~ | ~ |
| N2401 | Bottom | E | 8 | SH248CSP | HALL IC SWITCH SH248CSP VCC | ~ | ~ |
| N2600 | Top | M | 8 | IRDA_TFBS_GP2W_CIM | IRDA MIR XSMALL | ~ | ~ |
| N3200 | Top | G | 3 | USMD16_2.03X2.03 | VREG & LEVEL SHIFT LP3928 USMD16 | ~ | 2.8V |
| N6156 | Bottom | R | 5 | WFBGA34_2_3.57X3.57 | FM RECEIVER TEA5761UK N4B CSP (TI) | ~ | ~ |
| N6300 | Top | I | 3 | LFBGA_228 | WLAN MCM STLC4370 F3 LINEAR EM LFBGA228 | ~ | ~ |
| N6301 | Top | I | 2 | RF5924 | WLAN RF5924 ES3.5 | ~ | ~ |
| N6302 | Top | H | 2 | SOT_666 | TRX2+RX4 PEMD9 N&P 10K/47K 0W12 SOT666 | ~ | ~ |
| N7505 | Top | C | 4 | TFBGA144 | RFIC AHNE400A TRANSCEIVER TFBGA144 | ~ | ~ |
| N7520 | Top | D | 7 | RF9282E3.6 | PA RF9282E6.3 GSM/EDGE 850/900/1800/1900 | ~ | ~ |
| R2000 | Bottom | Q | 4 | 0402R | Resistor 5% 63mW | 220R | ~ |
| R2001 | Bottom | Q | 4 | uBGA11_2.15X1.65 | ASIP MIC W/ESD RES +CAP+ZDI BGA11 | ~ | ~ |
| R2002 | Top | Q | 3 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R2003 | Top | Q | 3 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R2004 | Top | Q | 2 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R2005 | Top | Q | 3 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R2006 | Bottom | Q | 3 | uBGA5 | ASIP 4XESD **PB-FREE** BGA5 | ~ | ~ |
| R2007 | Top | Q | 4 | uBGA11_1.6X2.15 | ASIP SILIC USB OTG / ESD BGA11 | ~ | ~ |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| R2008 | Top | Q | 4 | 0404_RP | RES NETWORK 0W06 220K/120K J 0404 | 220k/120k | ~ |
| R2009 | Top | Q | 4 | 0402R | Resistor 5% 63mW | 220R | ~ |
| R2070 | Top | P | 2 | 0402_NTH5 | NTC RES 47K J B=4050 +-3% 0402 | 47k | ~ |
| R2071 | Top | G | 3 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/50V | ~ |
| R2100 | Top | Q | 2 | FLIP_CHIP_8_1.7 X1.7 | ASIP SINGLE ENDED MICROPHONE INTERF BGA8 | ~ | ~ |
| R2101 | Top | P | 2 | 0402R | Resistor 5% 63mW | 220R | ~ |
| R2200 | Top | P | 8 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R2201 | Top | P | 7 | 0402R | Resistor 5% 63mW | 120k | ~ |
| R2202 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2203 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2204 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2205 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2206 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2207 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2208 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2209 | Top | P | 5 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2212 | Top | O | 5 | 0402R | Resistor 5% 63mW | 470R | ~ |
| R2213 | Top | P | 7 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R2214 | Top | P | 8 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R2216 | Top | Q | 7 | 0402R | CHIPRES 0W06 2M2 J 0402 | 2M2 | ~ |
| R2301 | Top | N | 7 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R2307 | Top | L | 4 | 0402R | Resistor 5% 63mW | 100R | ~ |
| R2400 | Top | O | 4 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R2401 | Top | O | 4 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R2402 | Bottom | D | 8 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R2403 | Top | N | 6 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R2404 | Top | G | 1 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/50V | ~ |
| R2405 | Top | F | 5 | 0402R | Resistor 5% 63mW | 47R | ~ |
| R2406 | Bottom | O | 6 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/50V | ~ |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| R2407 | Bottom | O | 3 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/50V | ~ |
| R2410 | Bottom | Q | 1 | 0402R | Resistor 5% 63mW | 120R | ~ |
| R2600 | Top | K | 8 | 0805R_THERM1 | CHIPRES 0W125 4R7 J 0805 | 4R7 | ~ |
| R2700 | Top | Q | 4 | uBGA8_1.47X1.47 | ASIP SIM INTERFACE **LOW CAP**BGA8 | ~ | ~ |
| R2701 | Bottom | D | 3 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2702 | Bottom | D | 3 | 0402R | Resistor 5% 63mW | 1k0 | ~ |
| R2803 | Top | I | 8 | 0402R | Resistor 5% 63mW | 100R | ~ |
| R2804 | Top | H | 8 | 0402R | Resistor 5% 63mW | 100R | ~ |
| R2805 | Top | G | 4 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R2806 | Top | F | 6 | 0402R | Resistor 5% 63mW | 68k | ~ |
| R3000 | Top | J | 5 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R3002 | Top | H | 8 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R3003 | Top | I | 8 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R3004 | Top | K | 7 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R3200 | Top | L | 1 | uBGA11_1.62X2.12 | ASIP EMIF04-MMC02F2**PB-FREE** | ~ | ~ |
| R3201 | Top | G | 4 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R3202 | Top | G | 3 | 0402R | Resistor 5% 63mW | 22k | ~ |
| R3203 | Top | K | 5 | 0402R | Resistor 5% 63mW | 100k | ~ |
| R3204 | Top | L | 4 | 0402R | Resistor 5% 63mW | 2k2 | ~ |
| R3205 | Top | G | 3 | 0402R | CHIPRES 0W06 33R F 100PPM 0402 | 33R | ~ |
| R3206 | Top | G | 4 | 0402R | CHIPRES 0W06 33R F 100PPM 0402 | 33R | ~ |
| R6156 | Bottom | R | 5 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R6157 | Bottom | Q | 6 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R6159 | Bottom | Q | 5 | 0402R | Resistor 5% 63mW | 10k | ~ |
| R6160 | Bottom | Q | 5 | 0402R | Resistor 5% 63mW | 100k | ~ |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| R6300 | Top | J | 3 | 0402R | CHIPRES 0W06 1M F 100PPM 0402 | 1M0 | ~ |
| R6301 | Top | J | 4 | 0402R | Resistor 5% 63mW | 1k2 | ~ |
| R6354 | Top | H | 4 | 0402R | Resistor 5% 63mW | 3k3 | ~ |
| R6398 | Top | G | 4 | 0402R | Resistor 5% 63mW | 68R | ~ |
| R6399 | Top | G | 4 | 0402R | Resistor 5% 63mW | 47R | ~ |
| R6410 | Top | K | 3 | 0402R | Chipres 0W06 jumper 0402 | 0R | ~ |
| R7501 | Top | C | 3 | 0402R | Resistor 5% 63mW | 2k2 | ~ |
| R7502 | Top | B | 4 | 0402R | CHIPRES 0W06 10K F 0402 | 10k | ~ |
| R7503 | Top | D | 4 | 0402R | Resistor 5% 63mW | 4k7 | ~ |
| R7505 | Top | C | 3 | 0402R | CHIPRES 0W06 8K2 F 0402 | 8k2 | ~ |
| R7506 | Top | D | 3 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R7507 | Top | B | 4 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R7508 | Top | D | 3 | 0402R | Resistor 5% 63mW | 10R | ~ |
| R7509 | Top | D | 3 | 0402R | Resistor 5% 63mW | 22k | ~ |
| R7510 | Top | D | 7 | 0402R | Resistor 5% 63mW | 15R | ~ |
| R7522 | Top | D | 7 | 0402R | CHIPRES 0W06 27K F 0402 | 27k | ~ |
| R7590 | Top | K | 1 | 0402R | Resistor 5% 63mW | 22k | ~ |
| R7591 | Top | K | 1 | 0402R | Resistor 5% 63mW | 68k | ~ |
| R7592 | Top | K | 2 | 0402R | Resistor 5% 63mW | 1k5 | ~ |
| R7593 | Top | J | 1 | 0402R | Chipres 0W06 jumper 0402 | 0R | ~ |
| S2416 | Top | E | 8 | SWITCH_EVQ5P701K | SM SW TACT SPST 12V SIDE KEY 3N | ~ | ~ |
| S2417 | Top | H | 8 | SWITCH_EVQ5P701K | SM SW TACT SPST 12V SIDE KEY 3N | ~ | ~ |
| S3200 | Top | O | 1 | SWITCH_SPVM110201 | SWITCH SPST NO 5V 1MA | ~ | ~ |
| T7501 | Top | C | 2 | TRANS_LDB15 | TRANSF BALUN 3800 +-550MHZ 0805 | ~ | ~ |
| T7520 | Top | C | 7 | TRANS_LDB15 | TRANSF BALUN 1800 +-100mhz 2x1.25 | ~ | ~ |
| V2000 | Top | O | 8 | BGA4_1.01X1.07 | ASIP TVS BGA4 | ~ | ~ |
| V2302 | Top | L | 4 | SOD323F | SCH DI 30V 2A SOD323F | ~ | ~ |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| V2400 | Bottom | O | 6 | LED_CL480S | LED WHITE MIN70MCD 5MA 90DEG 0603 | ~ | ~ |
| V2401 | Bottom | I | 6 | LED_CL480S | LED WHITE MIN70MCD 5MA 90DEG 0603 | ~ | ~ |
| V2402 | Bottom | I | 3 | LED_CL480S | LED WHITE MIN70MCD 5MA 90DEG 0603 | ~ | ~ |
| V2403 | Bottom | O | 3 | LED_CL480S | LED WHITE MIN70MCD 5MA 90DEG 0603 | ~ | ~ |
| V7590 | Top | K | 1 | SOT323 | Tr NPN 12V 35mA SOT323 | ~ | ~ |
| X2000 | Top | R | 4 | SYSCON_MQ202_NK_14R3 | SM SYSTEM CONNECTOR 14POL | ~ | ~ |
| X2060 | Bottom | B | 5 | TRACEABILITY_PAD | MODULE ID COMPONENT 2.8X1.8X0.3 | ~ | ~ |
| X2070 | Top | F | 3 | LYNX_BATT_CONN_H7.0 | SM BATTERY CONN 3POL SPR 12V 2A | ~ | ~ |
| X2400 | Bottom | D | 4 | CON_DF30FC_50DS_0.4V | CONN BTB 2X25F P0.4 30V 0.3A | ~ | ~ |
| X2401 | Top | G | 1 | SWITCH_EVQP4003M | SWITCH TACT SPST 15V 20MA HARD KNOB | ~ | ~ |
| X2701 | Top | P | 3 | SIM_CONN_470192001 | SM SIM CONN 6POL P2.54 | ~ | ~ |
| X3200 | Top | M | 2 | MOLEX_500873_0801 | CONN TRF/MICROSD 12POL P0.5 10V | ~ | ~ |
| X6300 | Top | G | 2 | RF_SWITCH_MS_156 | SM CONN RF JACK 50R 2W 6GHZ | ~ | ~ |
| X7505 | Top | B | 8 | RF_SWITCH_MS_156 | SM CONN RF JACK 50R 2W 6GHZ | ~ | ~ |
| Z2000 | Top | Q | 5 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/ 100MHz | ~ |
| Z2001 | Top | Q | 4 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/ 100MHz | ~ |
| Z2003 | Top | Q | 5 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/ 100MHz | ~ |
| Z2400 | Bottom | D | 6 | uBGA25_2.47X2.47 | ASIP 10-CH ESD EMI FILTER BGA25 | ~ | ~ |
| Z2403 | Bottom | B | 4 | uBGA25_2.47X2.47 | ASIP 10-CH ESD EMI FILTER BGA25 | ~ | ~ |
| Z2404 | Bottom | C | 3 | uBGA25_2.47X2.47 | ASIP 10-CH ESD EMI FILTER BGA25 | ~ | ~ |


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| Item | Side | Grid reference | | Description and value | | | |
|---|---|---|---|---|---|---|---|
| Z6300 | Top | H | 1 | FILTER_ERIN_4_2 | CER.FILT 2450 +-50MHZ/2DB 3.4X2.7X1.6MM | 2450MHz | ~ |
| Z6302 | Top | E | 1 | ANTENNA_NAN68 | ANTENNA INT WLAN P2636 | ~ | ~ |
| Z7501 | Top | C | 6 | FILTER_2.1X1.7_10P_H0.6 | DUAL RX SAW FILTER 1800/1900MHZ 2016 | 1800/1900 MHz | ~ |
| Z7503 | Top | D | 5 | MODULE_SP_LMZ_137 | TX SAW MODULE GSM 850/900MHZ 4.5X3.2 | 850/900M Hz | ~ |
| Z7504 | Top | C | 6 | FILTER_2.1X1.7_10P_H0.65 | DUAL RX SAW FILTER 850/900MHZ 2016 | 850/900M Hz | ~ |
| Z7520 | Top | B | 6 | FERRITE_FBMJ1608 | FERRITE BEAD 0R01 28R/100MHZ 0603 | 28R/ 100MHz | ~ |
| Z7521 | Top | C | 7 | FILTER_LFTC10N | CER FILT LFL181699TC1 2400-2480MHZ 1.6 | 2400-2483 MHz | ~ |


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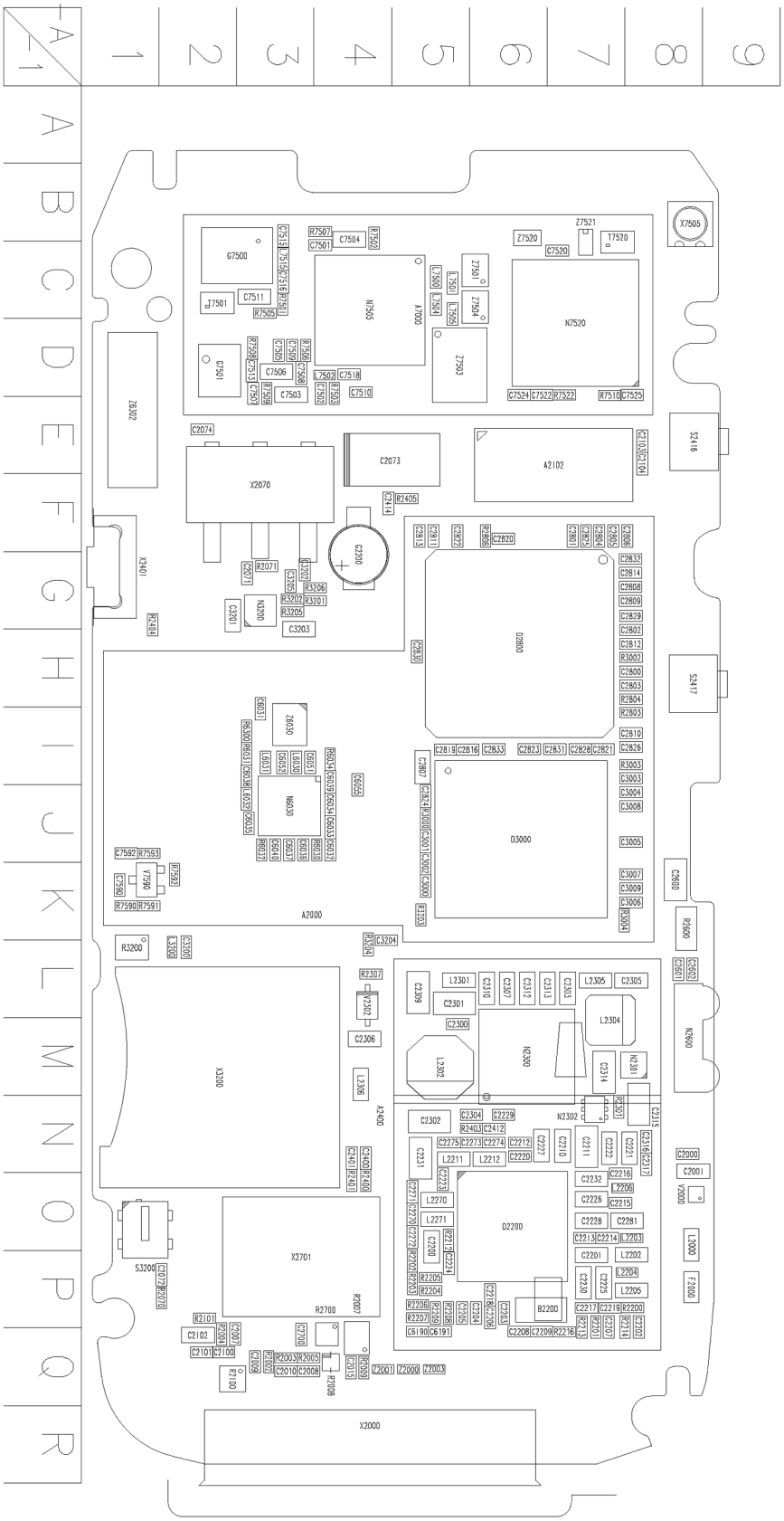
## Component layouts

### RM-178 component layout - top (1VA_02bb)

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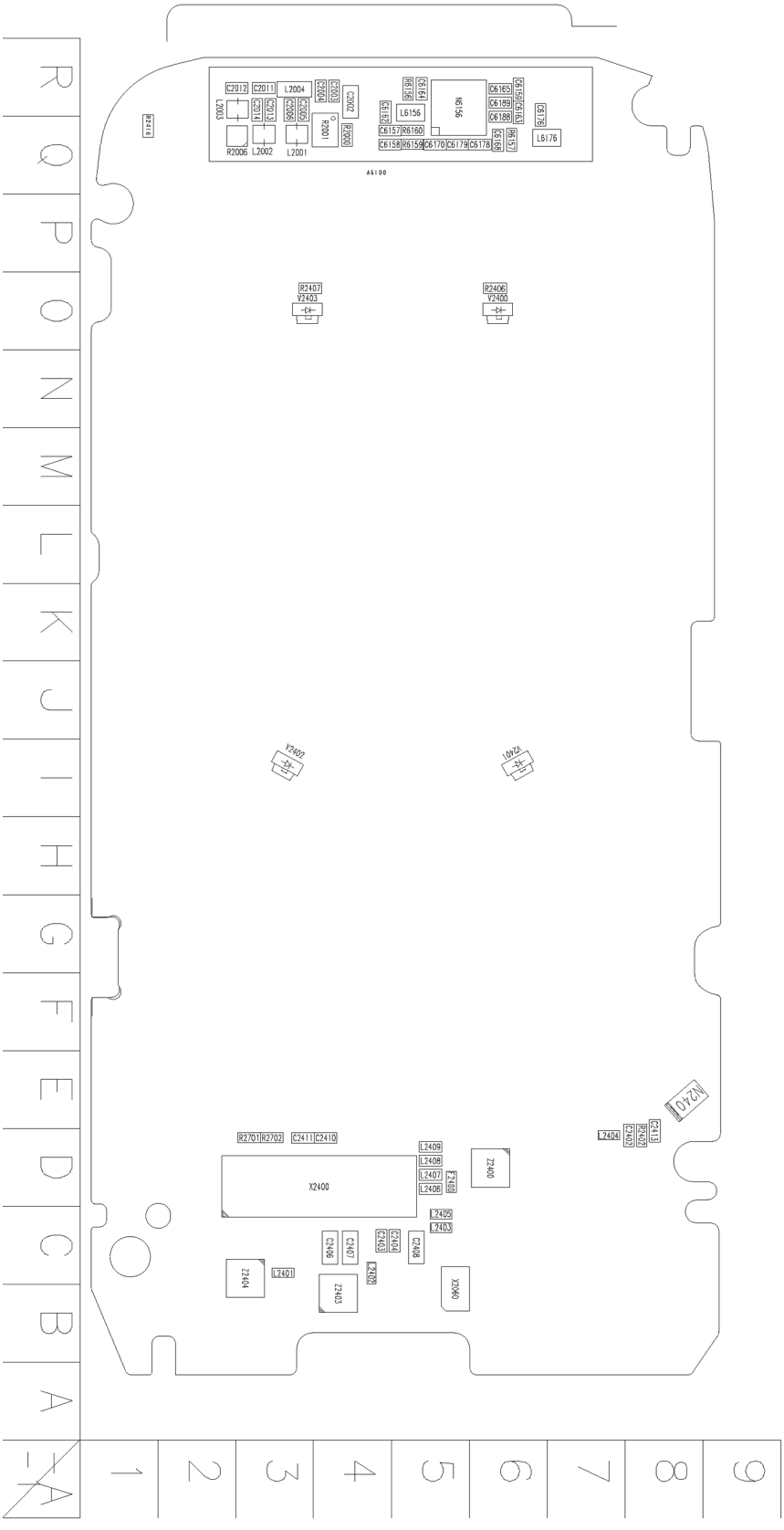
## RM-178 component layout - bottom (1VA_02bb)





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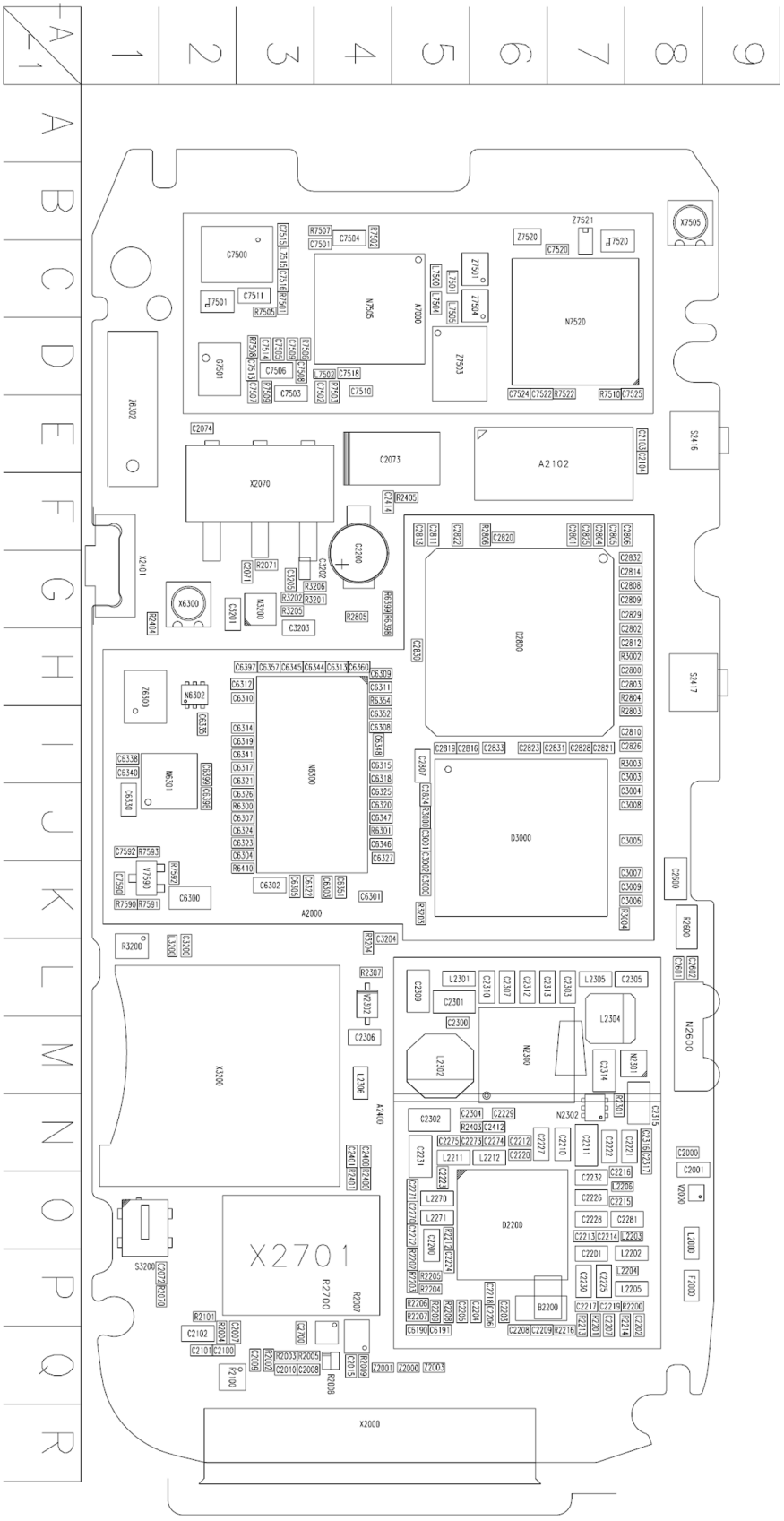
## RM-106/199 component layout - top (1PF_05bb)





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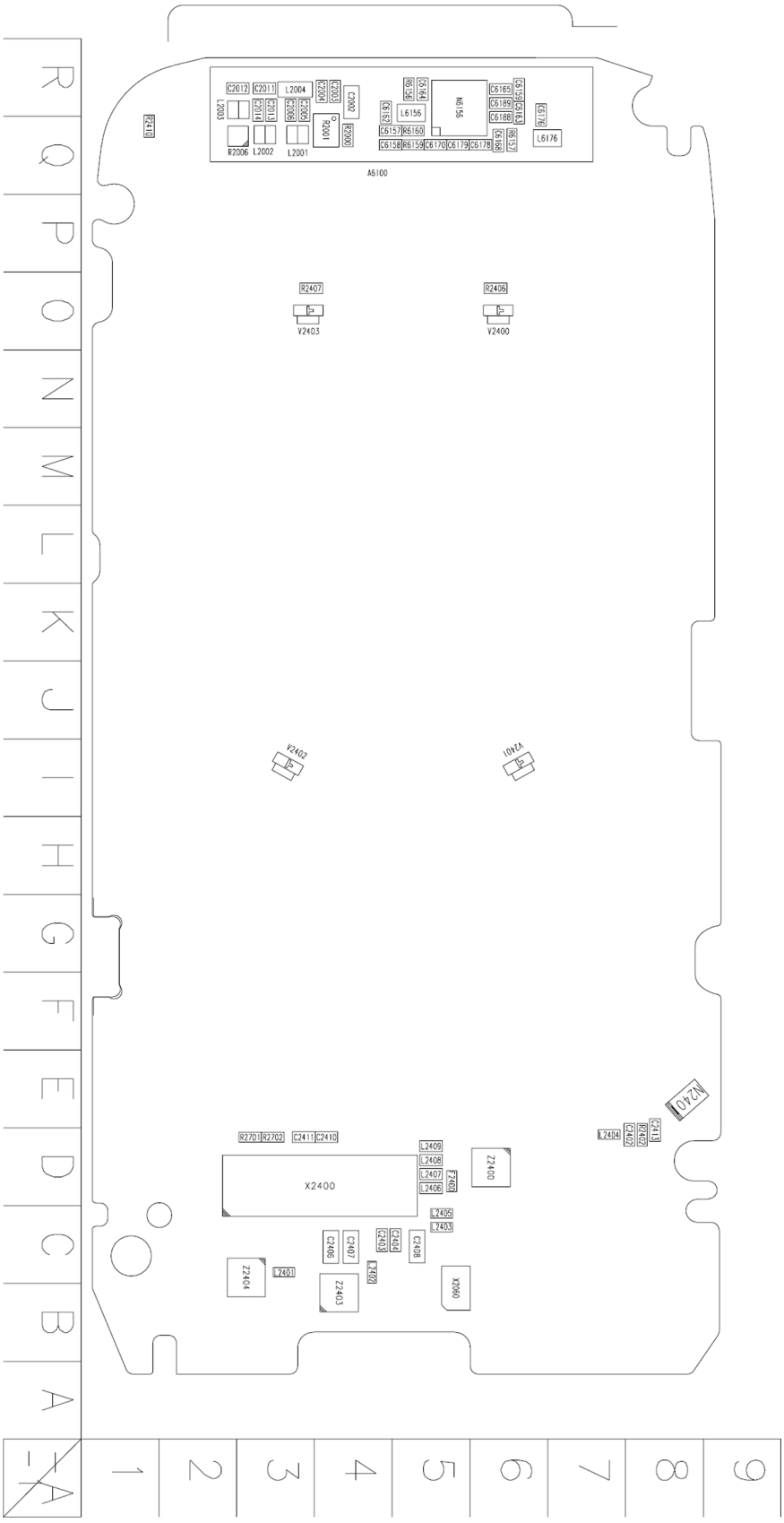
## RM-106/199 component layout - bottom (1PF_05bb)





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# 3 — Service Software Instructions


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## *Phoenix* installation steps in brief

### Prerequisites

Recommended hardware requirements:

- Computer processor: Pentium 700 MHz or higher
- RAM 256 MB
- Disk space 100-300 MB

Supported operating systems:

- *Windows 2000* Service Pack 3 or higher
- *Windows XP* Service Pack 1 or higher

### Context

*Phoenix* is a service software for reprogramming, testing and tuning phones.

*Phoenix* installation contains:

- Service software support for all phone models included in the package
- Flash update package files for programming devices
- All needed drivers for:
  - PKD-1 (DK2) dongle
  - DKU-2 USB cable

    **Note:** Separate installation packages for flash update files and drivers are also available, but it is not necessary to use them unless there are updates between *Phoenix* service software releases. If separate update packages are used, they should be used after *Phoenix* and data packages have been installed.

The phone model specific data package includes all changing product specific data:

- Product software binary files
- Files for type label printing
- Validation file for the faultlog repair data reporting system
- All product specific configuration files for *Phoenix* software components

  **Note:** *Phoenix* and phone data packages should only be used as complete installation packages. Uninstallation should be made from the *Windows* Control Panel.

To use *Phoenix*, you need to:

### Steps

1. Connect a PKD-1 (DK2) dongle to the computer parallel port.
2. Install *Phoenix*.
3. Install the phone-specific data package.
4. Configure users.
5. Manage connection settings (depends on the tools you are using).
   - Update FPS-10 software

     **Note:** There is no need to activate FPS-10.
   - Activate SX-4 smart card, if you need tuning and testing functions.

     **Note:** When FPS-10 is used only for product software updates, SX-4 smart card is not needed.


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## Results

*Phoenix* is ready to be used with FPS-10 flash prommer and other service tools.

# Installing *Phoenix*

## Prerequisites

- Check that a dongle is attached to the parallel port of your computer.
- Download the *Phoenix* installation package (for example, *phoenix_service_sw_2004_39_x_xx.exe*) to your computer (in *C:|TEMP*, for instance).
- Close all other programs.
- Depending on your operating system, administrator rights may be required to install *Phoenix*.
- If uninstalling or rebooting is needed at any point, you will be prompted by the InstallShield program.

## Context

At some point during the installation procedure, you may get the following message:

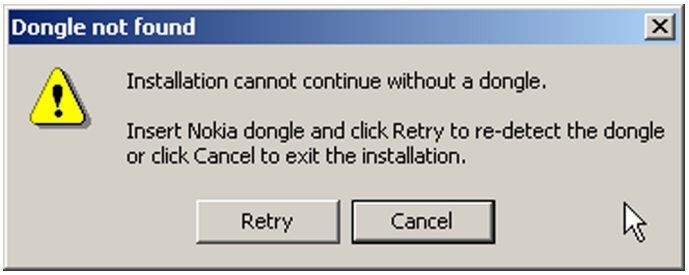


**Figure 3 Dongle not found**

This may be a result of a defective or too old PKD-1 dongle.

Check the COM/parallel ports used. After correcting the problem, you can restart the installation.

For more detailed information, please refer to *Phoenix* Help files.

> **Tip:** Each feature in *Phoenix* has its own Help function, which can be activated while running the program. Press the **F1** key or the feature's **Help** button to activate a Help file.

## Steps

1. To start the installation, run the application file (for example,*phoenix_service_sw_2004_39_x_xx.exe*).
2. In the *Welcome* dialogue, click **Next**.


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3. Read the disclaimer text carefully and click **Yes**.

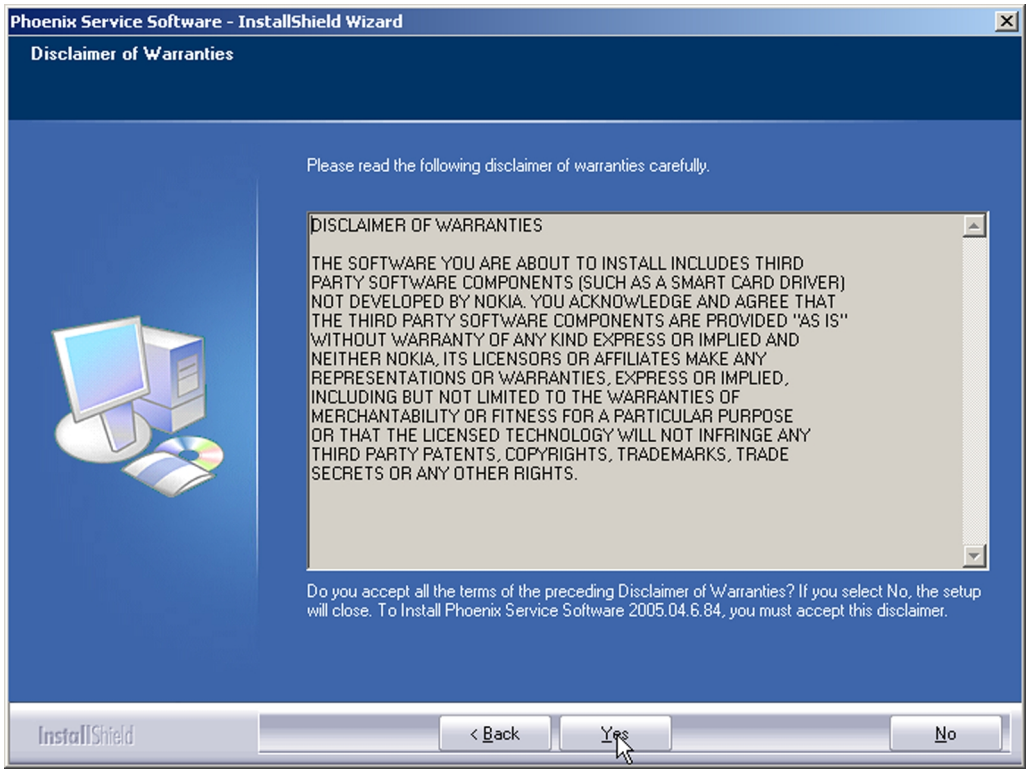


**Figure 4 Disclaimer text**

4. Choose the destination folder.
   The default folder *C:|ProgramFiles|Nokia|Phoenix* is recommended.
5. To continue, click **Next.**
   To choose another location, click **Browse** (not recommended).
6. Wait for the components to be copied.
   The progress of the installation is shown in the *Setup Status* window.
7. Wait for the drivers to be installed and updated.
   The process may take several minutes to complete.
   If the operating system does not require rebooting, the PC components are registered right away.
   If the operating system requires restarting your computer, the Install Shield Wizard will notifies about it.
   Select **Yes...** to reboot the PC immediately or **No...** to reboot the PC manually afterwards.
   After the reboot, all components are registered.

   **Note:** *Phoenix* does not work, if the components have not been registered.


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8. To end the installation, click **Finish**.

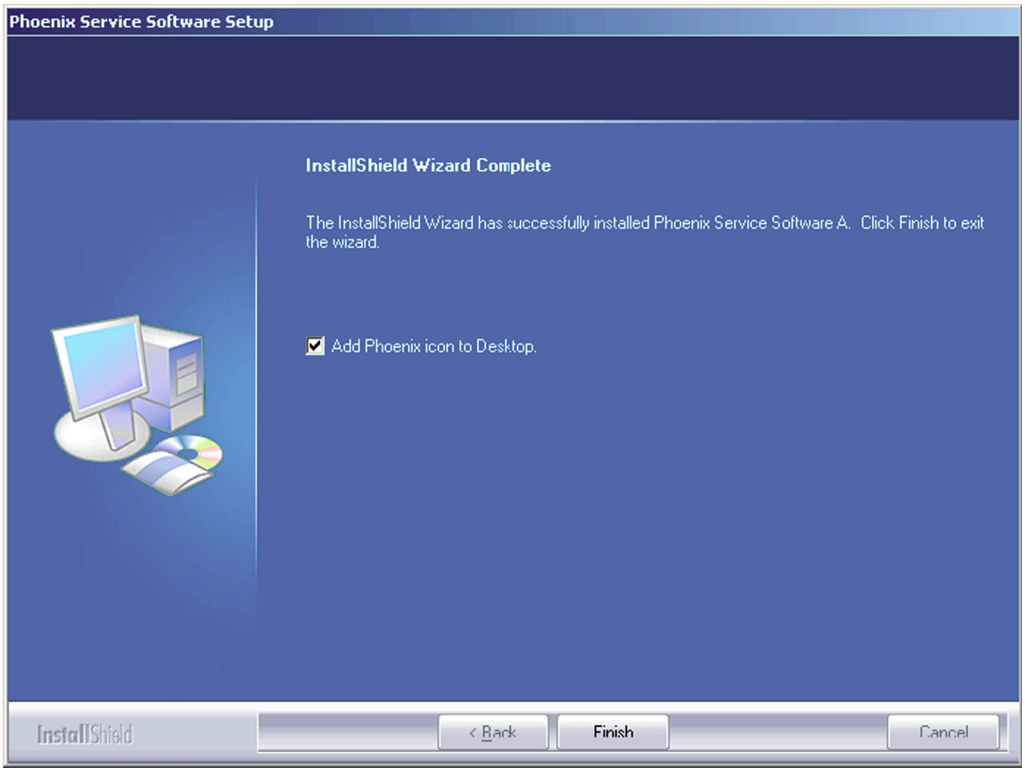


**Figure 5 InstallShield Wizard Complete**

## Next actions

After the installation, *Phoenix* can be used after:

- installing phone model specific data package for *Phoenix*
- configuring users and connections

FPS-10 flash prommer can be used after updating their flash update package files.

## Updating *Phoenix* installation

### Context

- If you already have the *Phoenix* service software installed on your computer, you need to update the software when new versions are released.
- To update *Phoenix*, you need to follow the same steps as when installing it for the first time.
- When you are updating, for example, from version **a14_2004_16_4_47** to **a15_2004_24_7_55**, the update will take place automatically without uninstallation.
- Always use the latest available versions of both *Phoenix* and the phone-specific data package. Instructions can be found in the phone model specific Technical Bulletins and phone data package *readme.txt* files (shown during installation).
- If you try to update *Phoenix* with the same version you already have (for example, **a15_2004_24_7_55** to **a15_2004_24_7_55**), you are asked if you want to uninstall the existing version. In this case you can choose between a total uninstallation or a repair installation in a similar way when choosing to uninstall the application from the *Windows* Control Panel.
- If you try to install an older version (for example, downgrade from **a15_2004_24_7_55** to **a14_2004_16_4_47**), installation will be interrupted.


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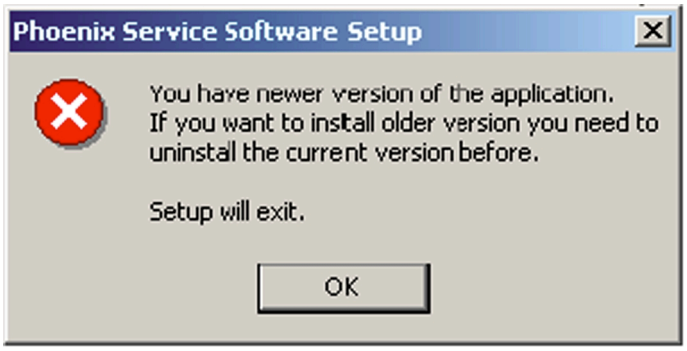


**Figure 6 Installation interrupted**

- Always follow the instructions on the screen.

### Steps

1. Download the installation package to your computer hard disk.
2. Close all other programs.
3. Run the application file (for example, *phoenix_service_sw_2004_39_x_xx.exe*).

### Results

A new *Phoenix* version is installed and driver versions are checked and updated.

## Uninstalling *Phoenix*

### Context

You can uninstall *Phoenix* service software manually from the *Windows* Control Panel.

### Steps

1. Open the **Windows Control Panel**, and choose **Add/Remove Programs**.


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2. To uninstall *Phoenix*, choose **Phoenix Service Software→Change/Remove→Remove** .

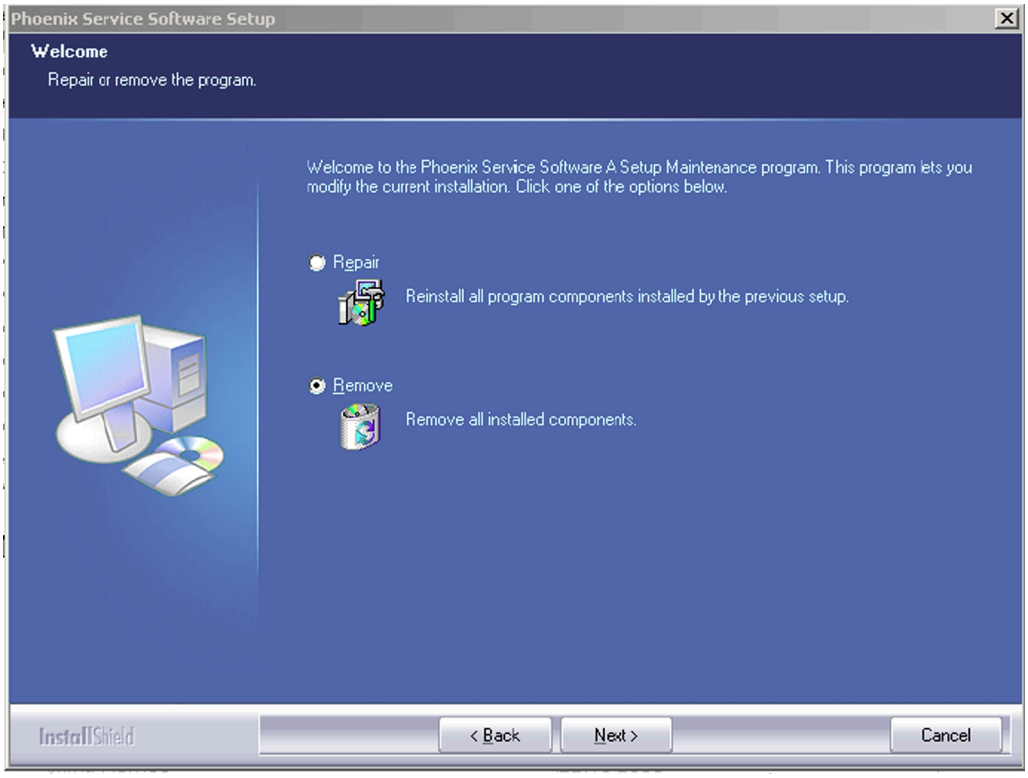


**Figure 7 Remove program**

The progress of the uninstallation is shown.

3. If the operating system does not require rebooting, click **Finish** to complete.

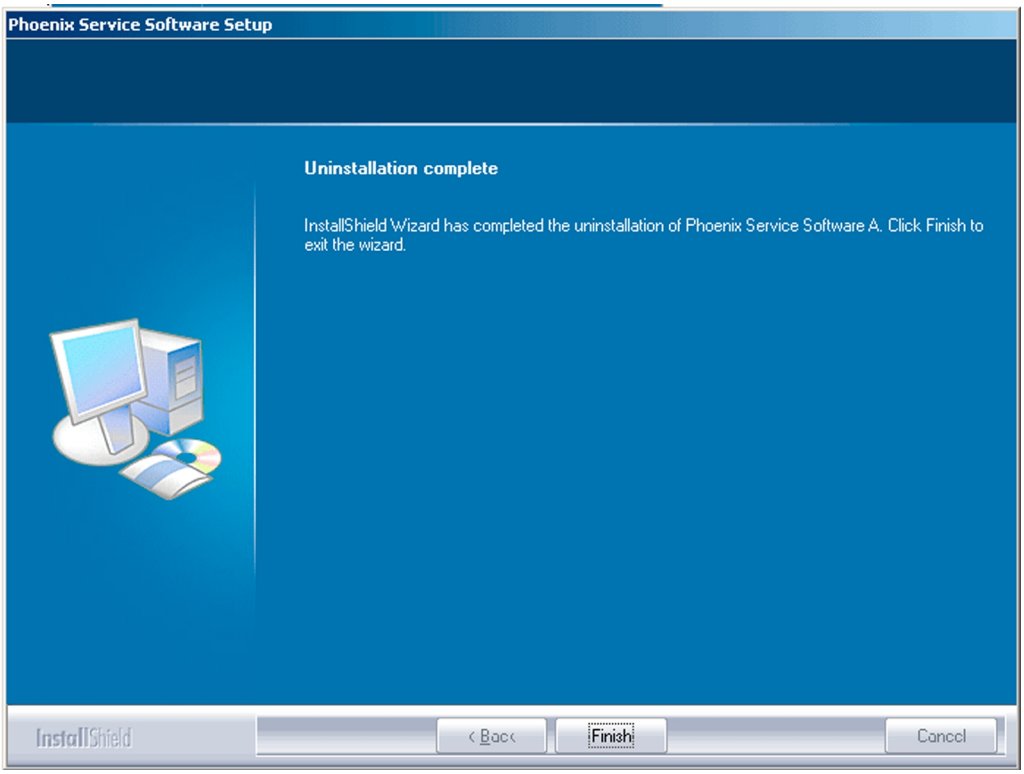


**Figure 8 Finish uninstallation**


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If the operating system requires rebooting, InstallShield Wizard will notify you. Select **Yes...** to reboot the PC immediately and **No...** to reboot the PC manually afterwards.

## Repairing *Phoenix* installation

### Context

If you experience any problems with the service software or suspect that files have been lost, use the repair function before completely reinstalling *Phoenix*.

**Note:** The original installation package (for example, *phoenix_service_sw_a15_2004_24_7_55.exe*) must be found on your PC when you run the repair setup.

### Steps

1. Open **Windows Control Panel→Add/Remove Programs** .
2. Choose **Phoenix Service Software→Change/Remove** .
3. In the following view, select **Repair**.

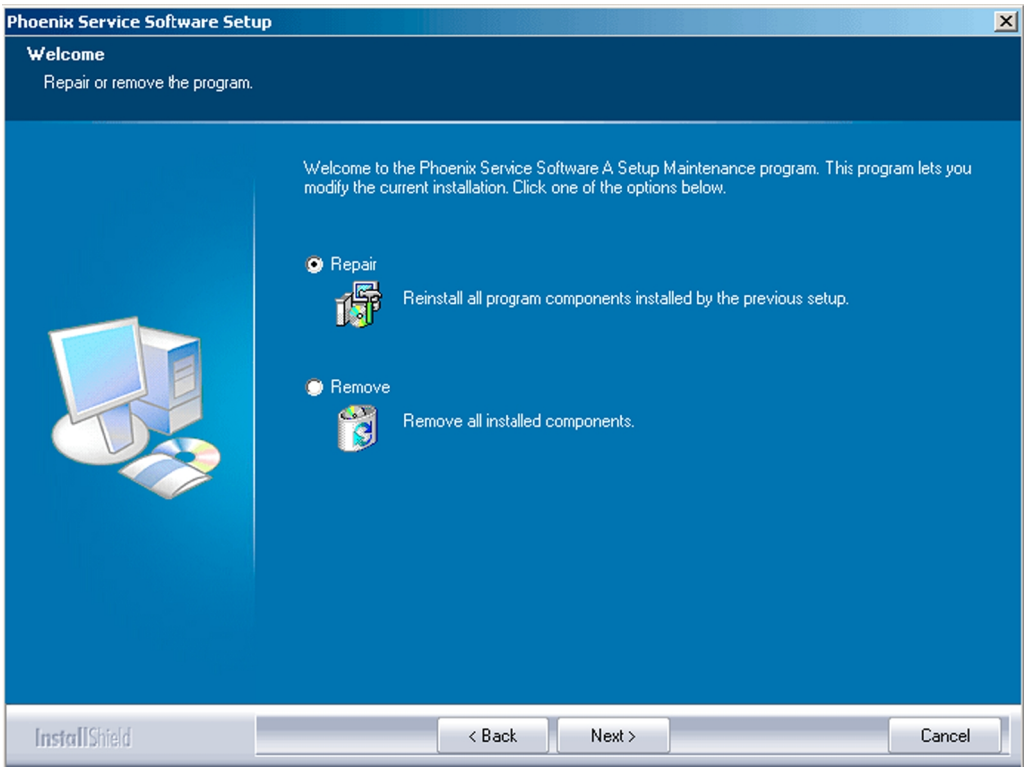


**Figure 9 Repair program**

*Phoenix* reinstalls components and registers them.

The procedure is the same as when updating *Phoenix*.

4. To complete the repair, click **Finish**.

## Phone data package overview

Each product has its own data package (DP). The product data package contains all product-specific data files to make the Phoenix service software and tools usable with a certain phone model.

The phone data package contains the following:

- Product software binary files


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- Files for type label printing
- Validation file for the fault log repair data reporting system
- All product-specific configuration files for Phoenix software components

Data files are stored in **C:\Program Files\Nokia\Phoenix** (default).

## Installing phone data package

### Prerequisites

- A phone-specific data package contains all data required for the *Phoenix* service software and service tools to be used with a certain phone model.
- Check that a dongle is attached to the parallel port of your computer.
- Install *Phoenix* service software.
- Download the installation package (for example, *XX-XX_dp_EA_v_1_0.exe*) to your computer (for example, in C:\TEMP).
- Close all other programs.

(XX-XX = type designator of the product)

If you already have *Phoenix* installed on your computer, you will need to update it when a new version is released.

> **Note:** Often *Phoenix* and the phone-specific data package come in pairs, meaning that a certain version of *Phoenix* can only be used with a certain version of a data package. Always use the latest available versions of both. Instructions can be found in phone-specific Technical Bulletins and *readme.txt* files of data packages.

### Steps

1. To start the installation, run the application file (for example, *XX-XX_dp_EA_ v_1_0.exe*),

   Wait for the installation files to be extracted.


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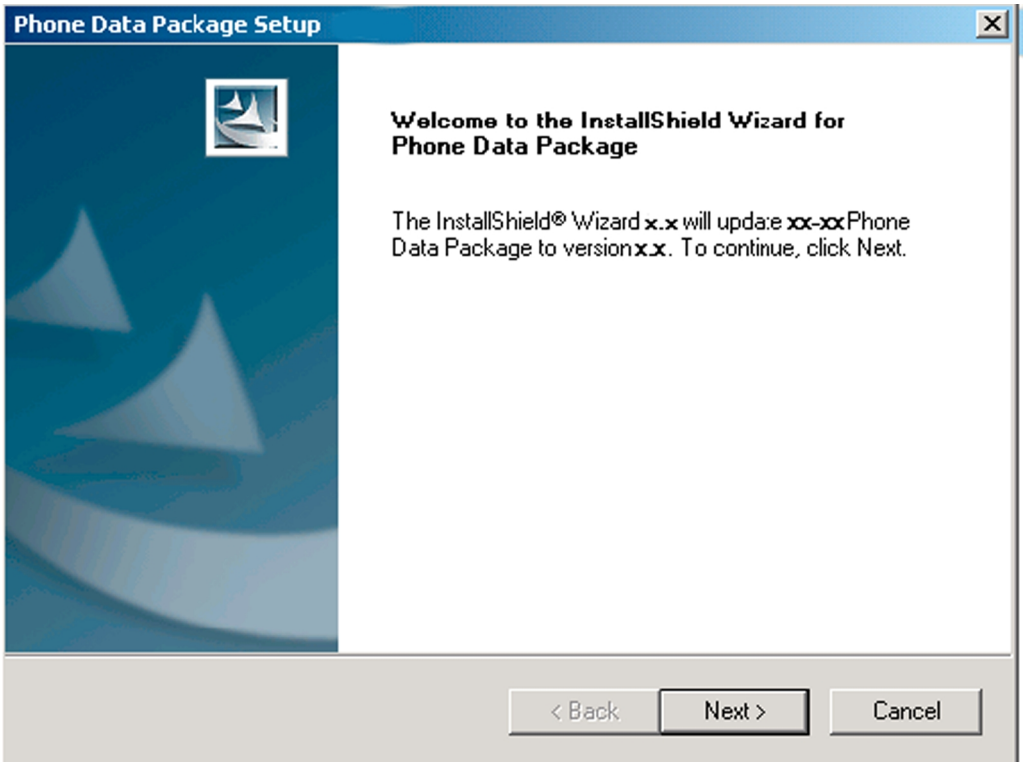
2. Click **Next**.




3. In the following view you can see the contents of the data package. Read the text carefully. There is information about the *Phoenix* version required with this data package.

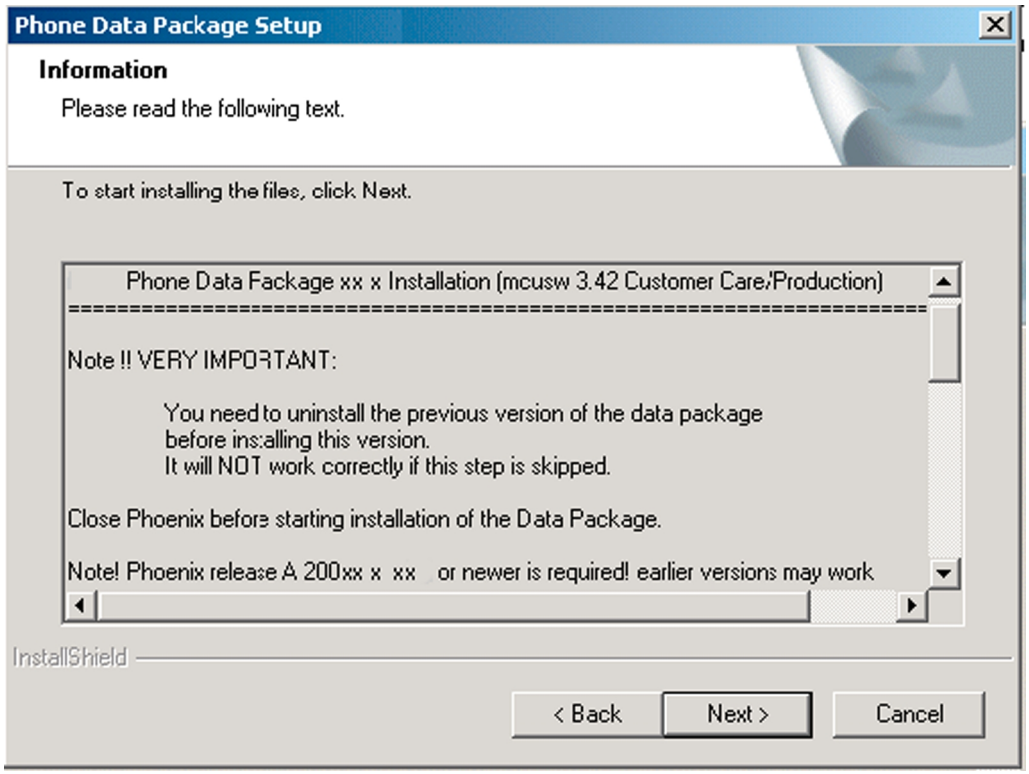



**Figure 10 Data package setup information**

4. To continue, click **Next**.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5. Choose the destination folder, and click **Next** to continue.

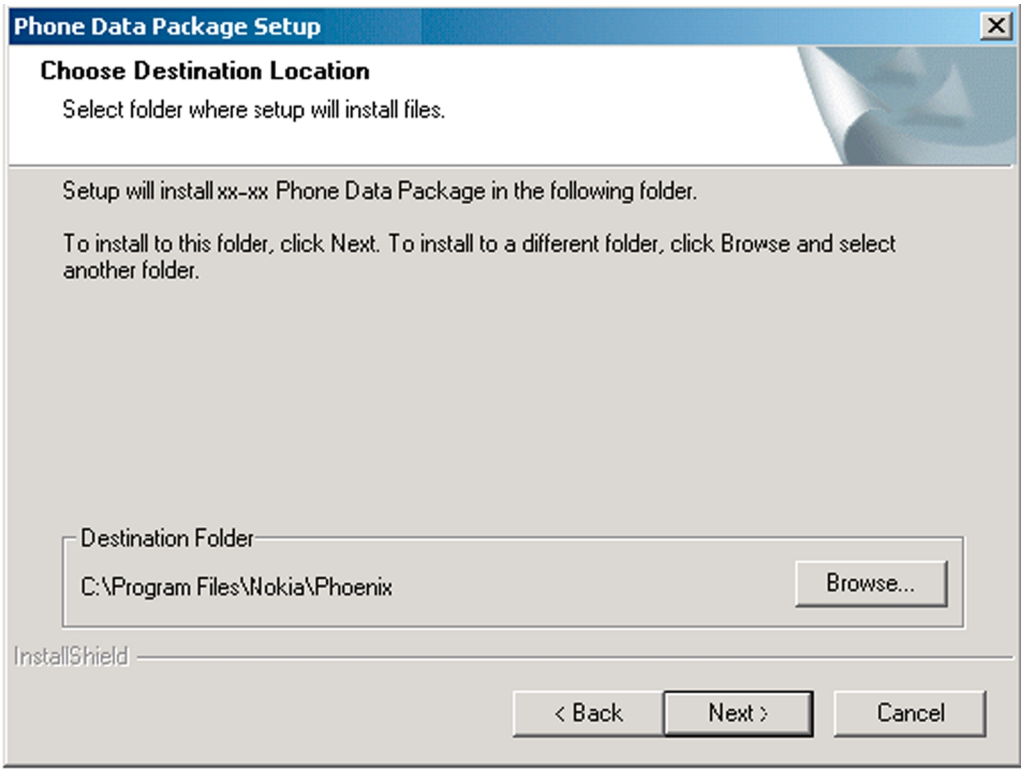
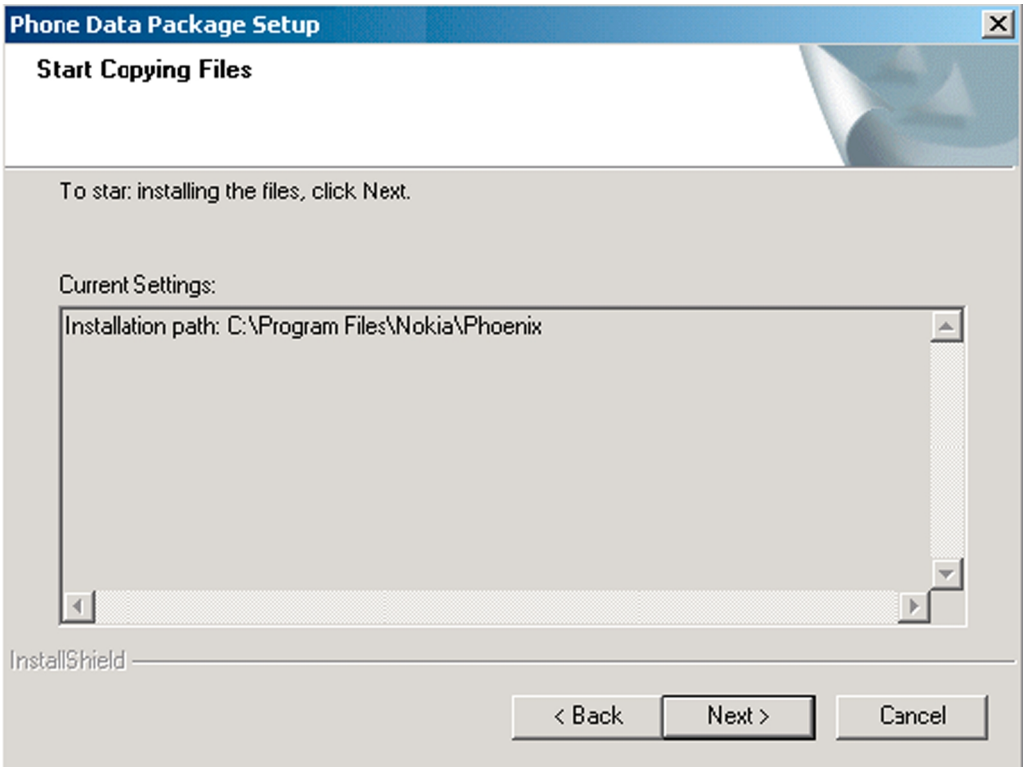



**Figure 11 Data package destination folder**

The InstallShield Wizard checks where *Phoenix* is installed, and the directory is shown.

6. To start copying the files, click **Next**.





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Phone model specific files are installed. Please wait.

7. To complete the installation, click **Finish**.

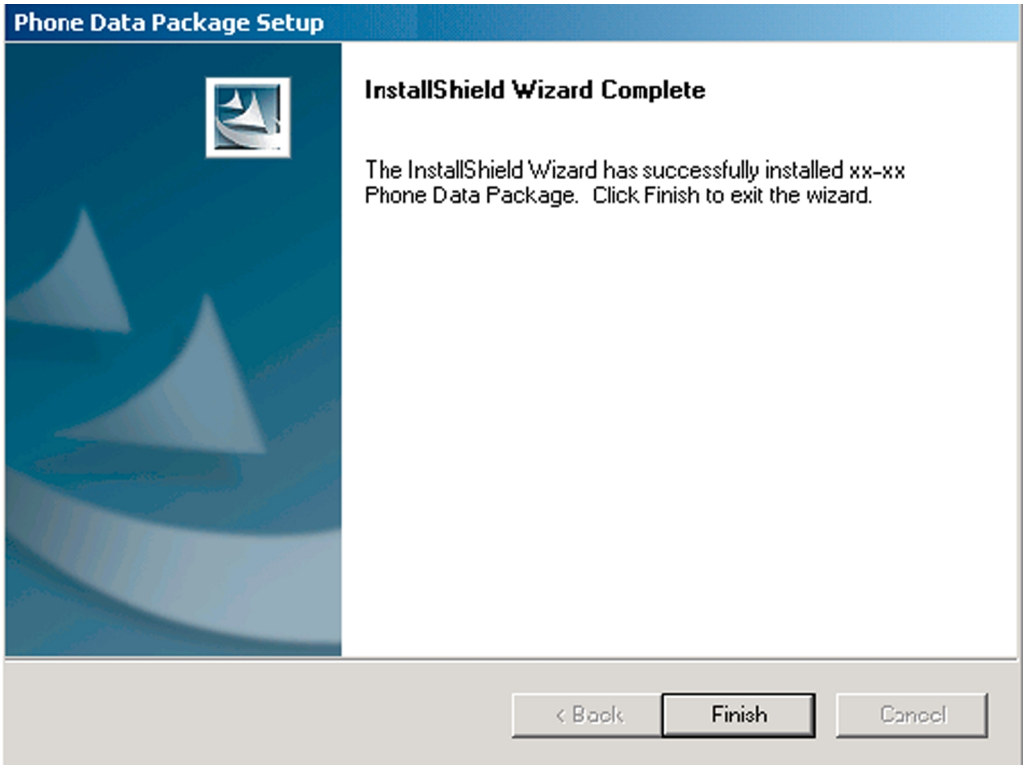


**Figure 12 InstallShield Wizard Complete**

### Next actions

*Phoenix* can be used for flashing phones and printing type labels after:

- Configuring users
- Managing connections

FPS-10 can be used after updating their flash update package files.

## Uninstalling phone data package

### Context

There is no need to uninstall an older version of a data package, unless instructions to do so are given in the *readme.txt* file of the data package and bulletins related to the release.

Please read all related documents carefully.

### Steps

1. Locate the data package installation file (e.g. *XX-XX_dp_EA_v_1_0.exe*) from your computer.
2. To start the uninstallation procedure, double-click the data package installation file.


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3. To uninstall the data package, click **OK** or to interrupt the uninstallation, click **Cancel**.

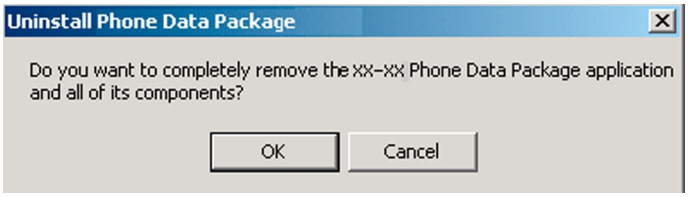


**Figure 13 Uninstalling phone data package**

4. When the data package is uninstalled, click **Finish**.

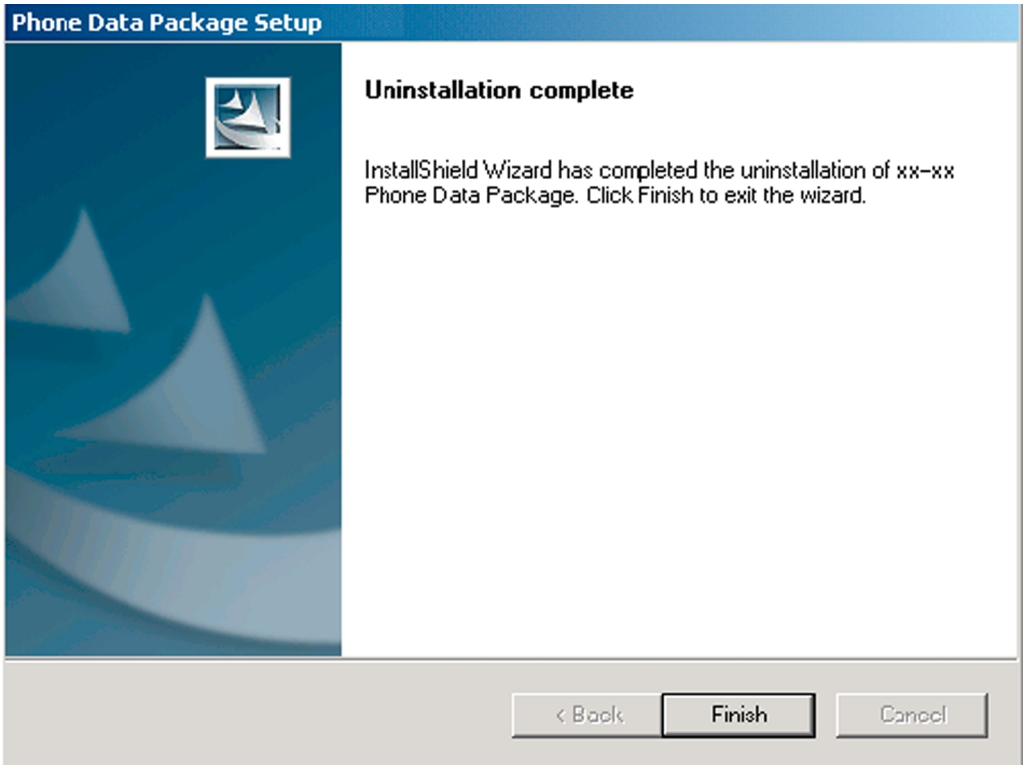


**Figure 14 Finishing data package uninstallation**

## Alternative steps

- You can also uninstall the data package manually from **Control Panel→Add/Remove Programs→xx-xx* Phone Data Package** . (*= type designator of the phone).


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## Configuring users in *Phoenix*

### Steps

1. Start *Phoenix* service software, and log in.

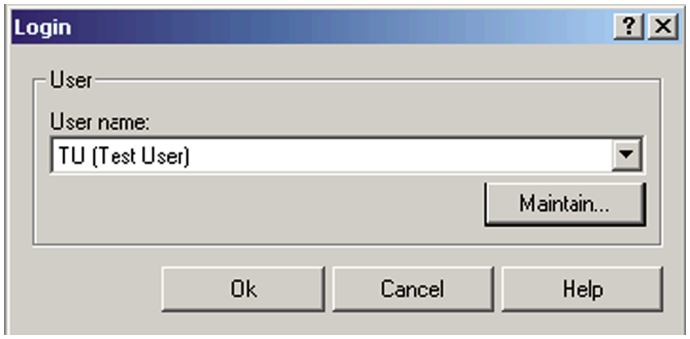


**Figure 15 Phoenix login**

   If the user ID is already configured, select s/he from the *User name* drop-down list, and click **OK**.
2. To add a new user, or to edit existing ones, click **Maintain**.
3. To add a new user, click **New**.
4. Type in the name and initials of the user, and click **OK**.
   The user is added to the user name list.
5. Select the desired user from the *User name* drop-down list, and click **OK**.

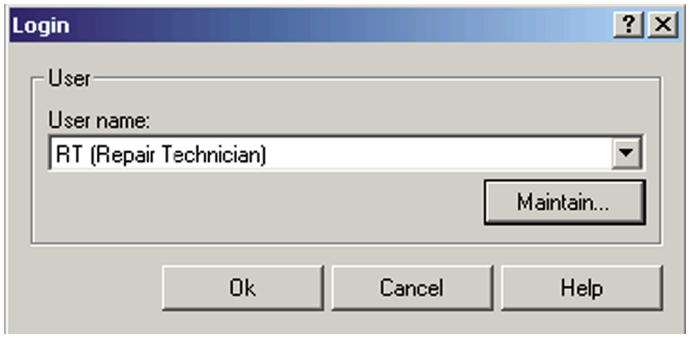


**Figure 16 New user configured**

## Managing connections in *Phoenix*

### Context

With the **Manage Connections** feature you can edit and delete existing connections or create new ones.

> **Note:** After choosing the desired connection, and connecting the phone to a PC for the first time, allow the PC to install the USB device drivers first. Please note that this may take some time to complete.
>
> If there are problems after the driver installation, check that the USB connection is active from the **Windows Control Panel**. If the problem persists, contact the local PC support.

### Steps

1. Start *Phoenix*, and log in.
2. Choose **File→Manage Connections...** .


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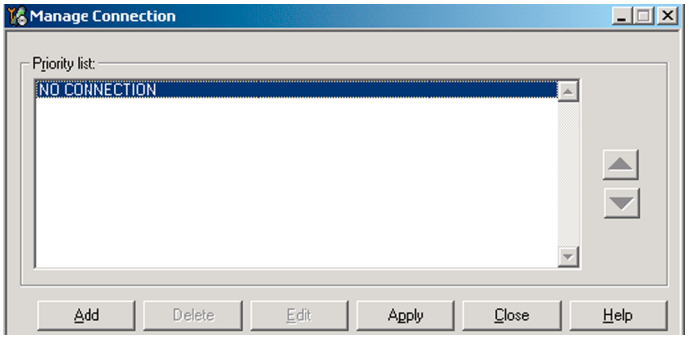
3. To add a new connection, click **Add**.




4. Select **Manual** mode, and click **Next** to continue.

   If you want to create the connection using the Connection Wizard, connect the tools and a phone to your PC. The wizard will automatically try to configure the correct connection.

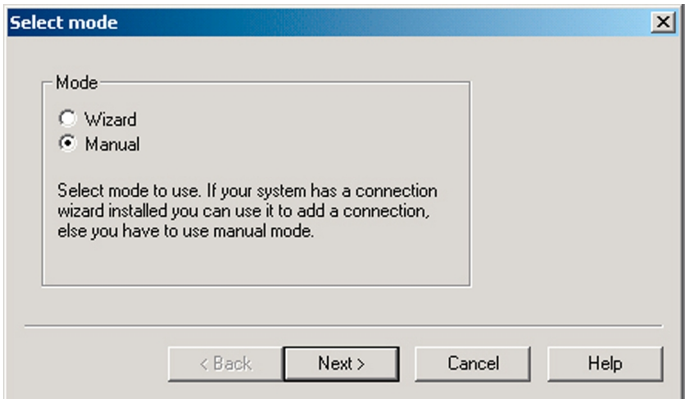



**Figure 17 Select mode: Manual**

i For an FPS-10 flash prommer with a **USB Connection**, choose the following connection settings:
   - Media: **FPS-10 USB**
   - DEVICE_INDEX: **0**
   - SERIAL_NUM: See Serial No from the label attached to the bottom of FPS-10
   - ACTIVE_MEDIA: **USB**

ii For an FPS-10 flash prommer with a **LAN connection**, choose the following connection settings:
   - Media: **FPS-10 TCP/IP**
   - NET_SERV_NAME: Click **Scan...**. Choose your own FPS-10 device based on the correct MAC address. See Serial No from the label attached to the bottom of your FPS-10.
   - PORT_NUM: Use the default value, and click **Next**.
   - PROTOCOL_FAMILY: Use the default value, and click **Next**.
   - SOCKET TYPE: Use the default value, and click **Next**.
   - TX_BUFFER_SIZE: Use the default value, and click **Next**.
   - RX_BUFFER_SIZE: Use the default value, and click **Next**.

iii For an FPS-8 flash prommer, choose the following connection settings:
   - Media: FPS-8
   - PORT_NUM: COM Port where FPS-8 is connected
   - COMBOX_DEF_MEDIA: **FBUS**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iv For a plain **USB connection**, choose the following connection settings:

**Note:** First connect the DKU-2 USB cable between the PC USB port and phone.

- Media: USB

5. To complete the configuration, click **Finish**.
6. Click the connection you want to activate. Use the up/down arrows located on the right hand side to move it on top of the list, then click **Apply**.

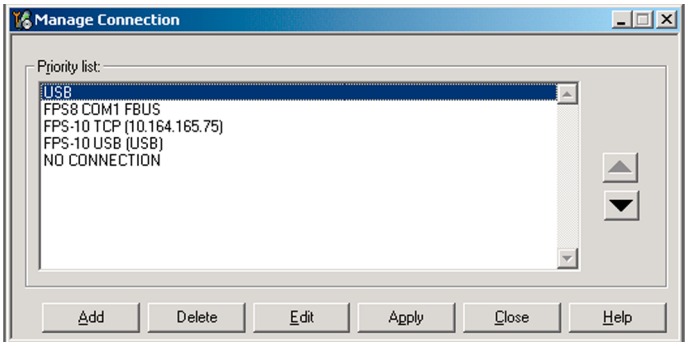


**Figure 18 Connections list**

The connection is activated, and it can be used after closing the *Manage Connection* window.

The connection information is shown at the right hand bottom corner of the screen.

**Figure 19 Connection information**

7. To use the connection, connect the phone to your PC with correct service tools. Make sure the phone is switched on, and then choose **File→Scan Product** .

## Results

The product support module information appears in the status bar:

**Figure 20 Product support module information (example from RM-1)**

# Installing flash support files for FPS-10

## Prerequisites

**Note:** You need to install flash support files for FPS-10 only, if you don't have the latest Phoenix available or the flash support files have changed after the latest Phoenix release.

- Flash support files are installed automatically, when you install Phoenix. Use Phoenix packages later than June 2006.
- Normally it is enough to install Phoenix and the phone-specific data package because the Phoenix installation always includes the latest flash update package files for FPS-10.
- A separate installation package for flash support files is available, and the files can be updated according to this instruction, if updates appear between new Phoenix / data package releases

## Context

If you are not using a separate installation package, you can skip this section and continue with updating FPS-10 flash prommer software after installing a new phone data package.


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## Steps

1. To begin installation, double- click *flash_update_x_yy.exe* .

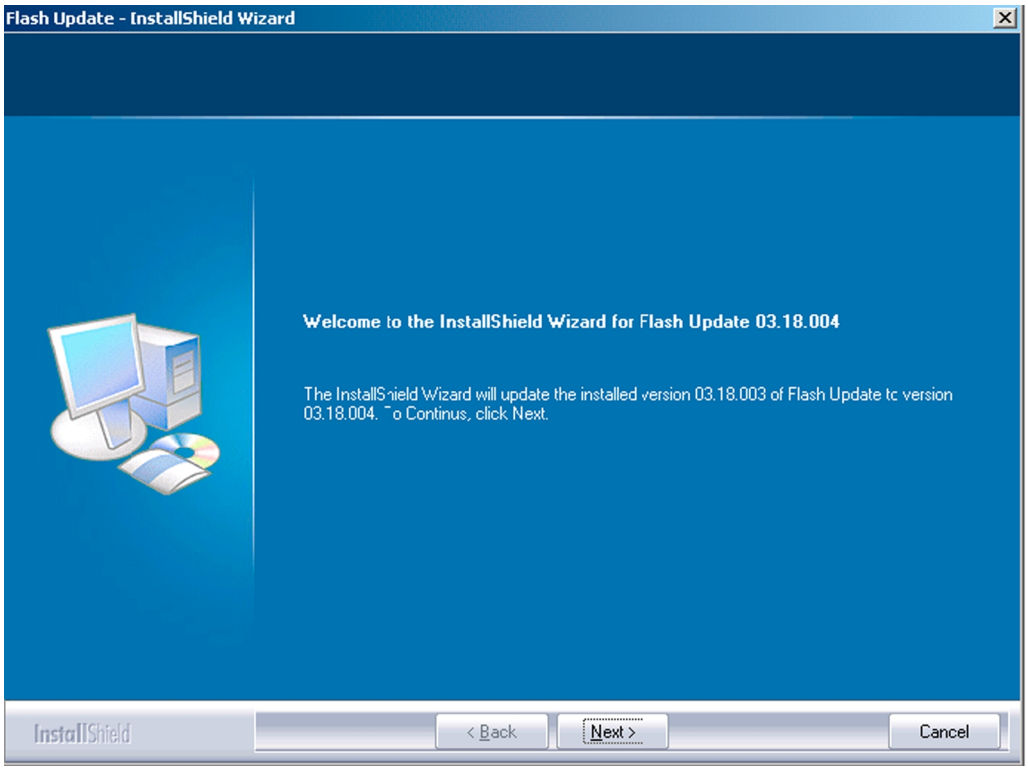


**Figure 21 Flash update welcome dialog**

If the same version of Flash Update package already exists, and you want to reinstall it, the previous package is first uninstalled. Restart installation again after that.

2. If you try to downgrade the existing version to older ones, the setup will be aborted. If you really want to downgrade, uninstall newer files manually from **Control Panel** and then rerun the installation again.

**Figure 22 Flash installation interrupted**

If an older version exists on your PC and it needs to be updated, click **Next** to continue installation.


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3. It is highly recommended to install the files to the default destination folder *C:|Program Files|Nokia |Phoenix*. Click **Next** to continue.

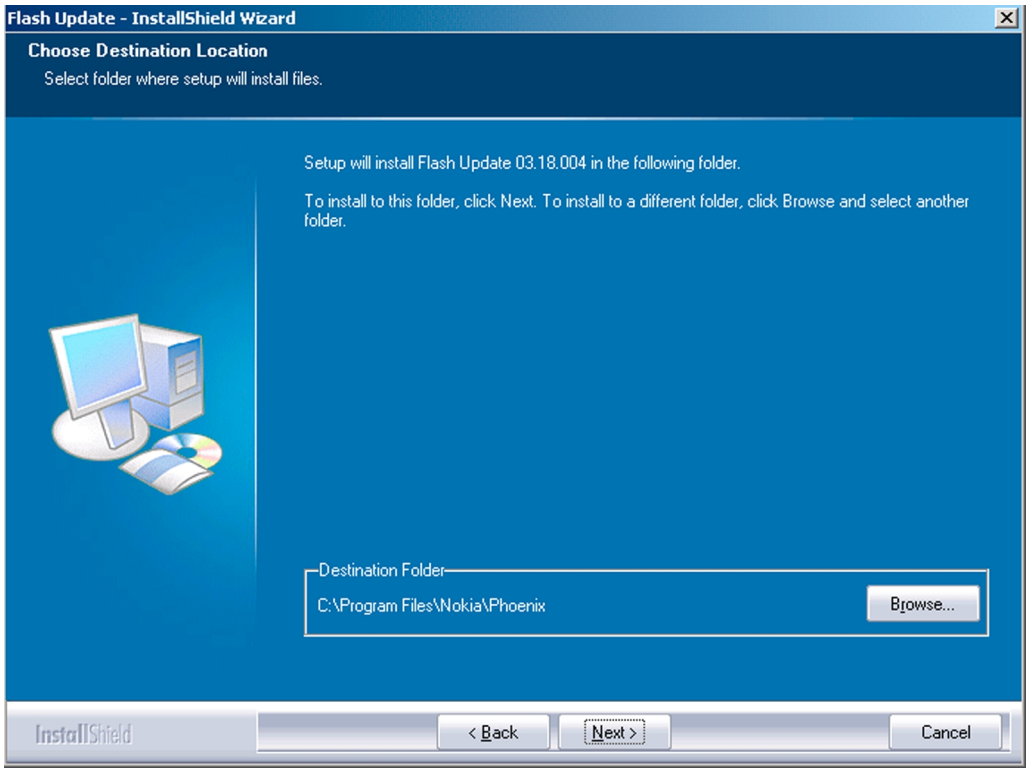


**Figure 23 Flash destination folder**

When installing the flash update files for the first time you may choose another location by selecting **Browse**. However, this is not recommended.


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4. To complete the installation procedure, click **Finish** .

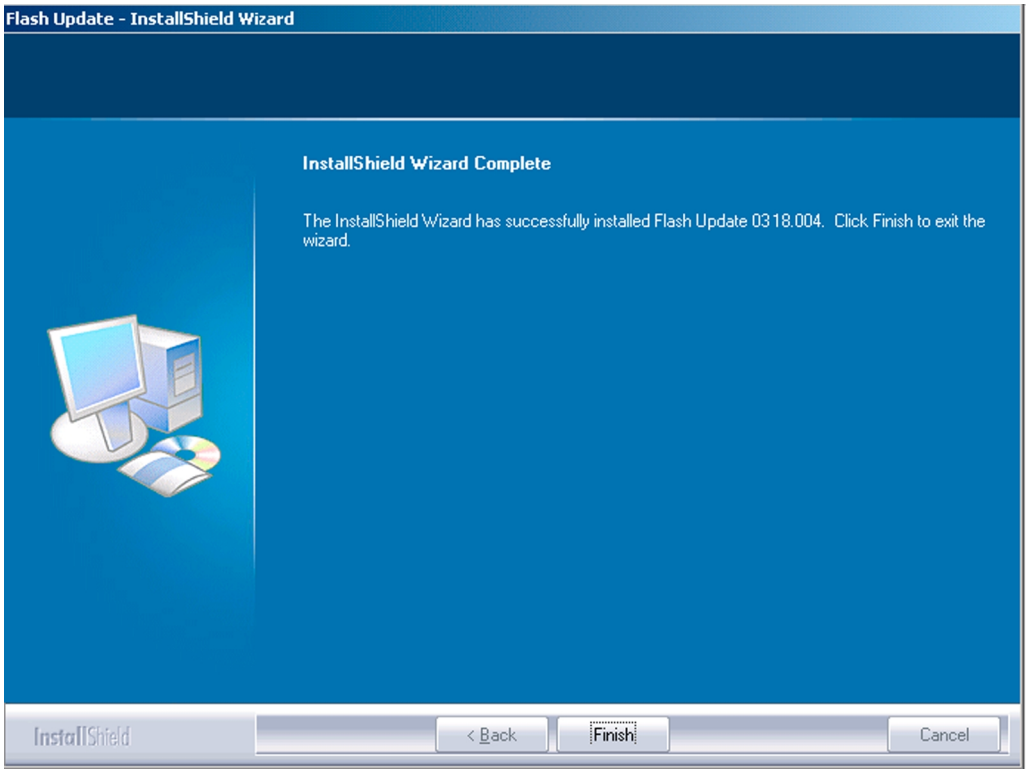


**Figure 24 Finish flash update**

## Next actions

FPS-10 flash prommers must be updated using Phoenix!

## Updating FPS-10 flash prommer software

## Steps

1. Start *Phoenix Service Software* and log in, manage connection correctly for your flash prommer.
2. Choose **Flashing→Prommer maintenance** .
3. When the new flash update package is installed to the computer you will be asked to update the files to your Prommer. To update the files, click **Yes**. Click **OK** if the computer informs you about an unsafe removal of the device.
4. Alternatively you can update the FPS-10 flash prommer software by clicking the **Update** button.


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5. Wait until you are notified that update has been successful; the procedure will take a couple of minutes. Click **OK** to close the *Update Done* window.

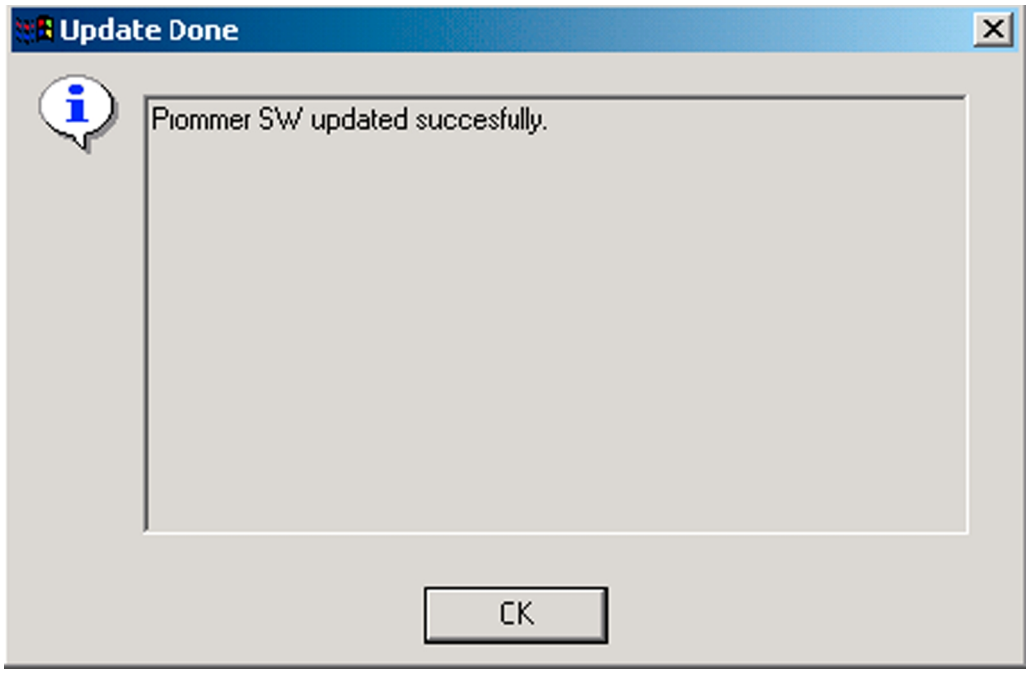


**Figure 25 Prommer SW update finished**

6. If you are using the FPS-10 flash prommer, check that it is detected from the progress info. Check also the status leds in the FPS-10. The MODE2 led (green), VBAT and POWER leds (red) should be lit. If you are using LAN connection, the LAN led (yellow) should be blinking.
7. Check that your FPS-10 flash prommer has enough memory. Flashing the SU-18 with FPS-10 needs at least 128 MB of SRAM memory in the prommer.

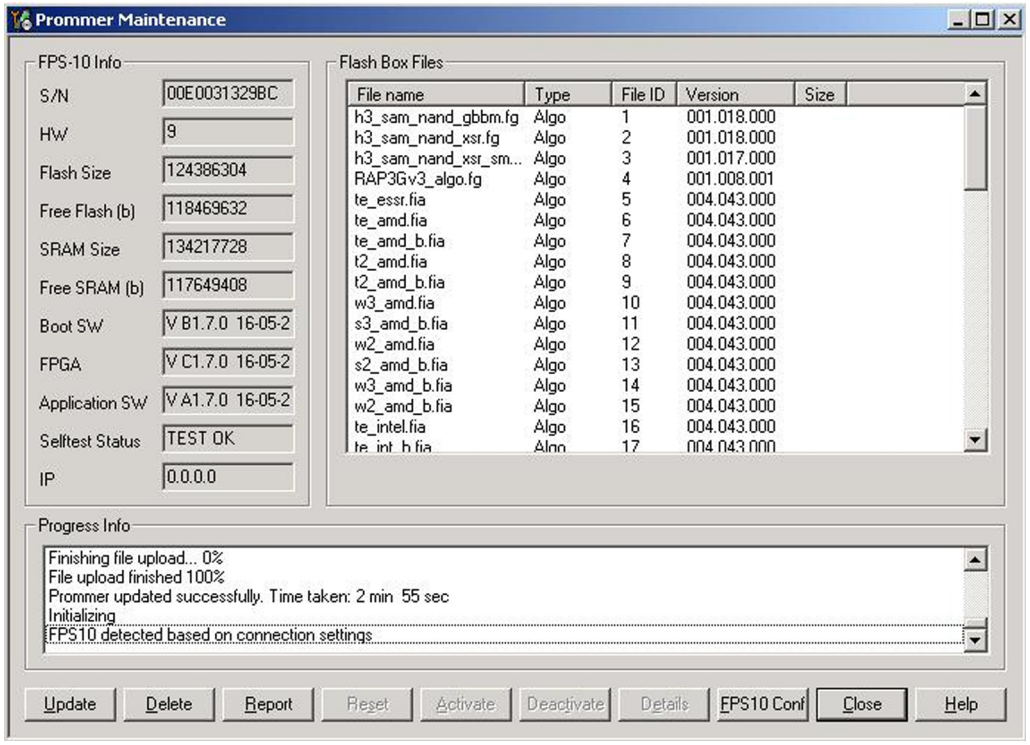


**Figure 26 Prommer maintenance window**


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## Alternative steps

- You can update FPS-10 SW by clicking the **Update** button and selecting the appropriate fpsxupd.ini file in *C:|Program Files|Nokia|Phoenix|Flash*.

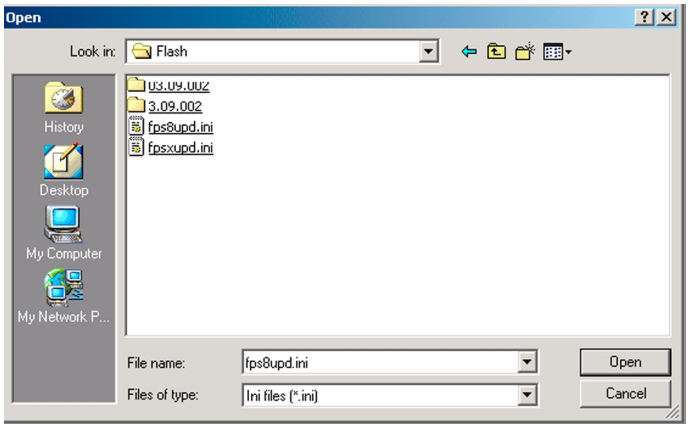


**Figure 27 Flash directory window**

- All files can be loaded separately to the prommer used. To do this, click the right mouse button in the *Flash box files* window and select the file type to be loaded.

  More information can be found in Phoenix **Help**.


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# 4 — Service Tools and Service Concepts


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## Service tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-178; RM-106; RM-199, refer to various concepts.

| | | | |
|---|---|---|---|
| | AC-33 | Power supply | |
| | Universal power supply for FPS-10; included in the FPS-10 sales package. | | |
| | CA-28DS | Service data cable | |
| | The CA-28DS service cable is used to connect FLS-4S to the POS flash adapter for supplying a controlled operating voltage and data connection.<br>**Note:** Old XCS-1 cable can be used as well. | | |
| | CA-31D | USB cable | |
| | The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages. | | |
| | CA-35S | Power cable | |
| | CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter. | | |


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| CA-41PS | Power cable | |
|---|---|---|

Power cable for connection of e.g. the JBV-1 docking station to the FPS-10 prommer box.

| CA-53 | USB connectivity cable | |
|---|---|---|

USB to system connector cable.

| CA-58RS | RF tuning cable | |
|---|---|---|

RF tuning cable for use with a flash adapter.

CA-58RS RF cable extends adapter features to allow RF function tests and RF tuning in GSM bands.

Features include:

- easy to use together with flash adapter or even stand alone
- most accurate RF connection to phone module under test
- most accurate RF connection to phone module under test
- low attenuation and small “ripple” over the width of each GSM band

**Note:** The RF cable must be used for RF tuning.

- **Table 9 Attenuation values**

| Band | Tuning channel | Attenuation Rx | Attenuation Tx |
|---|---|---|---|
| GSM900 | Rx: 942.4 MHz,Tx: 897.4 MHz | 0.25 dB | 0.25 dB |
| GSM1800 | Rx: 1842.8 MHz,Tx: 1747.8 MHz | 0.37 dB | 0.35 dB |
| GSM1900 | Rx: 1950 MHz,Tx: 1880 MHz | 0.4 dB | 0.38 dB |
| WCDMA2100 | Rx: 2140 MHz,Tx: 1960 MHz | 0.4 dB | 0.4 dB |
| WLAN | 2442 MHz | 0.42 dB | 0.42 dB |


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| | | |
|---|---|---|
| CA-5S | DC cable | |

The DC cable CA-5S is used to connect JBV-1 to the phone charger jack for ADC/VCHAR/ICHAR calibration

**Note:** Old SCB-3 can be used as well.


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| CU-4 | Control unit | |
|---|---|---|

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

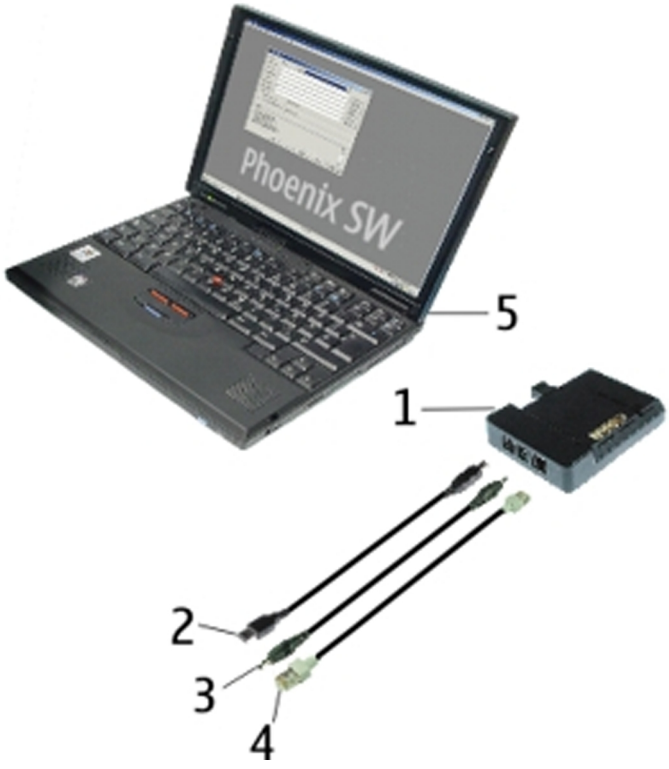
The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

## Instructions

1 Connect a service tool (jig, flash adapter) to CU-4.
2 Connect CU-4 to your PC with a USB cable.
3 Connect supply voltage (12 V)
4 Connect an FBUS cable (if necessary).
5 Start Phoenix service software.




**Note:** Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.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| DAU-9S | MBUS cable | |
|---|---|---|

The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.

**Note:** Docking station adapters valid for DCT4 products.

| DKU-2 | USB connectivity cable | |
|---|---|---|

USB to system connector cable.

| FLC-2 | DC cable | |
|---|---|---|

FLC-2 is used with a flash adapter to supply a controlled operating voltage.


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<table>
<tr><td rowspan="2"> </td><td>FLS-4S</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-4S is a dongle and flash device incorporated into one package, developed specifically for POS use.</td></tr>
<tr><td rowspan="2"> </td><td>FPS-10</td><td>Flash prommer</td><td></td></tr>
<tr><td colspan="3">FPS-10 interfaces with:<br>• PC<br>• Control unit<br>• Flash adapter<br>• Smart card<br>FPS-10 flash prommer features:<br>• Flash functionality for BB5 and DCT-4 terminals<br>• Smart Card reader for SX-2 or SX-4<br>• USB traffic forwarding<br>• USB to FBUS/Flashbus conversion<br>• LAN to FBUS/Flashbus and USB conversion<br>• Vusb output switchable by PC command<br>FPS-10 sales package includes:<br>• FPS-10 prommer<br>• Power Supply with 5 country specific cords<br>• USB cable</td></tr>
<tr><td rowspan="2"> </td><td>FS-10</td><td>product specific adapter</td><td></td></tr>
<tr><td colspan="3">Flash adapter FS-10 is used for phone testing and flashing. FS-10 is used with the generic flash adapter base and control Unit CU-4 or interface adapter.<br>When flashing or system testing the phone, the adapter is attached to replace the phone own battery. All functions (as well as the calibration voltages, current and the protections for over voltages, over current and voltage polarity), are performed by CU-4.</td></tr>
</table>


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| JBT-9 | Bluetooth test and interface box (sales package) | |
|---|---|---|

The JBT-9 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .

Sales package includes:

- JBT-9 test box
- Installation and warranty information

| MJ-77 | Module jig | |
|---|---|---|

MJ-77 is meant for component level troubleshooting.

The jig includes an RF interface for GSM and Bluetooth. In addition, it has the following features:

- Provides mechanical interface with Engine module
- Provides galvanic connection to all needed test pads in module
- Multiplexing between USB and FBUS media, controlled by Vusb
- UI test interface
- Duplicated SIM connector
- Audio components: IHF, MIC, earpiece
- Connector for control unit
- Access for Pop-Port™ system connector

**Note:** In the picture CU-4 is connected to MJ-77 . CU-4 is not part of the MJ-77 sales package and has to be ordered separately.

| PCS-1 | Power cable | |
|---|---|---|

The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled operating voltage.


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| | | | |
|---|---|---|---|
| | PKD-1 | SW security device | |
| | SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.<br>Without the device, it is not possible to use the service software.<br>Printer or any such device can be connected to the PC through the device if needed. | | |
| | RJ-84 | Soldering jig | |
| | RJ-84 is a soldering jig used for soldering and as a rework jig for the engine module. | | |
| | RJ-93 | Rework jig | |
| | RJ-93 is used as a rework jig for the engine module.<br>This stencil takes the front end module (FEM) or power amplifier (PA) module for spreading the soldering paste to the component. Must be used together with the ST-40 stencil. | | |


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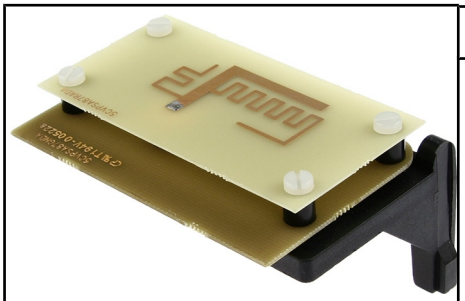

| SA-87 | RF coupler | |
|---|---|---|

SA-87 is a coupler for GSM RF testing. It is used together with FS-10 flash adapter.

- **Attenuation values for inductive RF coupler SA-XX**

| Band | Channel | Attenuation RX | Tolerance RX | Attenuation TX | Tolerance TX |
|---|---|---|---|---|---|
| GSM 850 | Low | 3 | | 4.6 | |
| | Mid | 3 | | 4 | |
| | High | 2.5 | +/-2dB | 3.6 | +/-1dB |
| GSM 900 | Low | 3 | | 3.9 | |
| | Mid | 3.5 | | 4 | |
| | High | 3.5 | +/-2dB | 4.5 | +/-1dB |
| GSM 1800 | Low | 8.5 | | 6 | |
| | Mid | 8 | | 7.7 | |
| | High | 8 | +/-2dB | 9.3 | +/-1dB |
| GSM 1900 | Low | 8.5 | | 8.6 | |
| | Mid | 8.5 | | 9.2 | |
| | High | 8 | +/-2dB | 9.8 | +/-1dB |
| WCD MABand I | Low | | | | |
| | Mid | | | | |
| | High | | | | |
| WCD MABand II | Low | | | | |
| | Mid | | | | |
| | High | | | | |
| WCD MABand V | Low | | | | |

For other WCDMA Bands please modify table according to sheet WCDMA Bands


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| | | | |
|---|---|---|---|
| | SA-94 | RF coupler | |

SA-94 is a coupler for bluetooth and WLAN testing.

- **Attenuation values for inductive RF coupler SA-XX**

| Band | Channel | Attenuation RX | Tolerance RX | Attenuation TX | Tolerance TX |
|---|---|---|---|---|---|
| WLAN (BT) | Low | | | | |
| | Mid | | | | |
| | High | | | | |

| | | | |
|---|---|---|---|
| | SPS-1 | Soldering Paste Spreader | |

| | | | |
|---|---|---|---|
| | SRT-6 | Opening tool | |

SRT-6 is used to open phone covers and B-to-B connectors.

| | | | |
|---|---|---|---|
| | SS-34 | Flex opening tool | |


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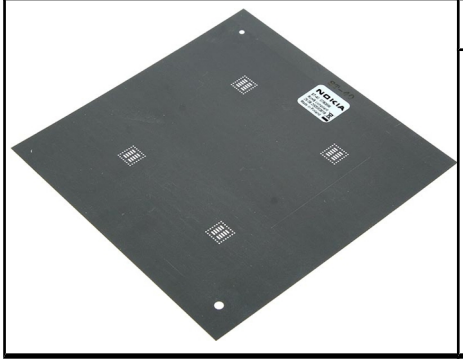
| | | | |
|---|---|---|---|
| | SS-45 | Front camera removal tool | |
| | The front camera removal tool SS-45 is used to remove/attach the front camera module from/to the socket. | | |
| | SS-46 | Interface adapter | |
| | SS-46 acts as an interface adapter between the flash adapter and FPS-10. | | |
| | SS-62 | Flash adapter base | |
| | Generic base for flash adapters and couplers. | | |
| | SS-84 | Domesheet and LCD aligning jig | |
| | | | |
|  | ST-40 | PA rework stencil | |
| | This stencil is to be used together with RJ-93 and covering FEM module. | | |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| | | | |
|---|---|---|---|
| | SX-4 | Smart card | |
| | SX-4 is a BB5 security device used to protect critical features in tuning and testing.<br>SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed. | | |
| | XCS-4 | Modular cable | |
| | XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes. | | |
| | XRF-1 | RF cable | |
| | The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.<br>SMA to N-Connector ca. 610mm.<br>Attenuation for:<br>• GSM850/900: 0.3+-0.1 dB<br>• GSM1800/1900: 0.5+-0.1 dB<br>• WLAN: 0.6+-0.1dB | | |


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## Service concepts

### Flash concept with FPS-10

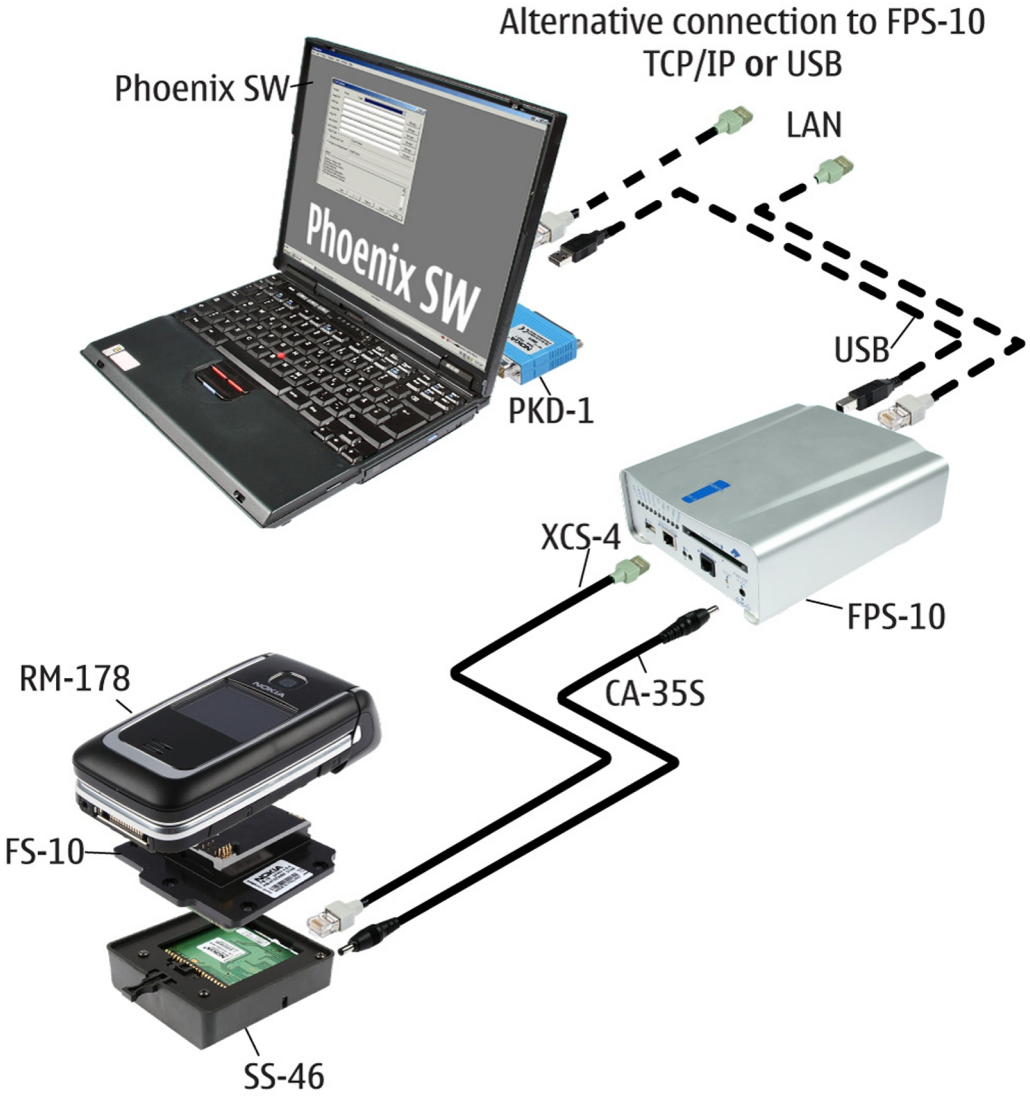


**Figure 28 Basic flash concept with FPS-10**

| Description | Type |
|---|---|
| FS-10 | Flash adapter |
| SS-46 | Interface adapter |
| CA-35S | Power cable |
| XCS-4 | Modular cable |
| FPS-10 | Flash prommer box |
| | Standard USB cable |
| PKD-1 | SW security device |


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## Flash concept with FPS-10 (USB)

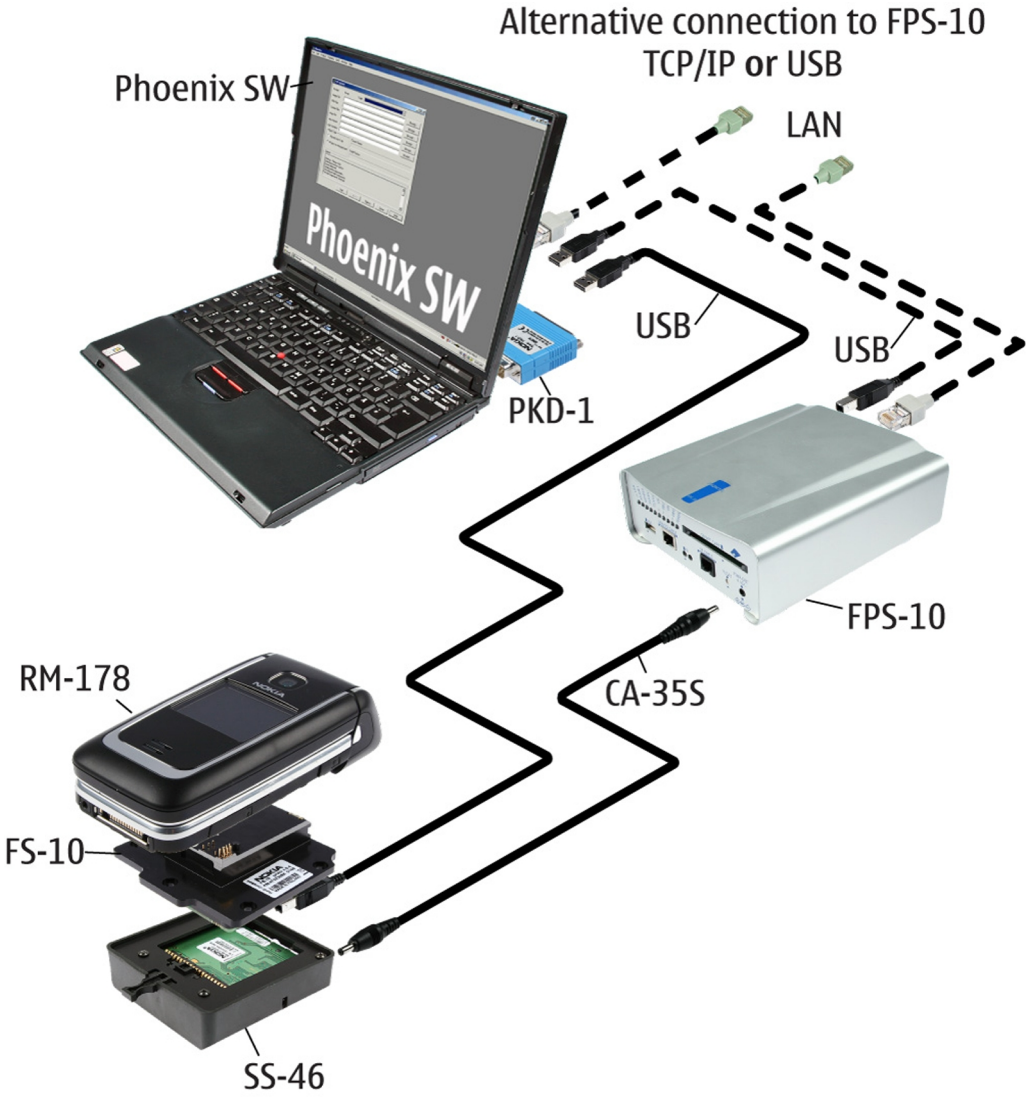


**Figure 29 Flash concept with FPS-10**

| Description | Type |
|---|---|
| FS-10 | Flash adapter |
| SS-46 | Interface adapter |
| CA-35S | Power cable |
| FPS-10 | Flash prommer box |
| | Standard USB cable |
| | Standard USB cable |
| PKD-1 | SW security device |


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## MJ-77 module jig concept

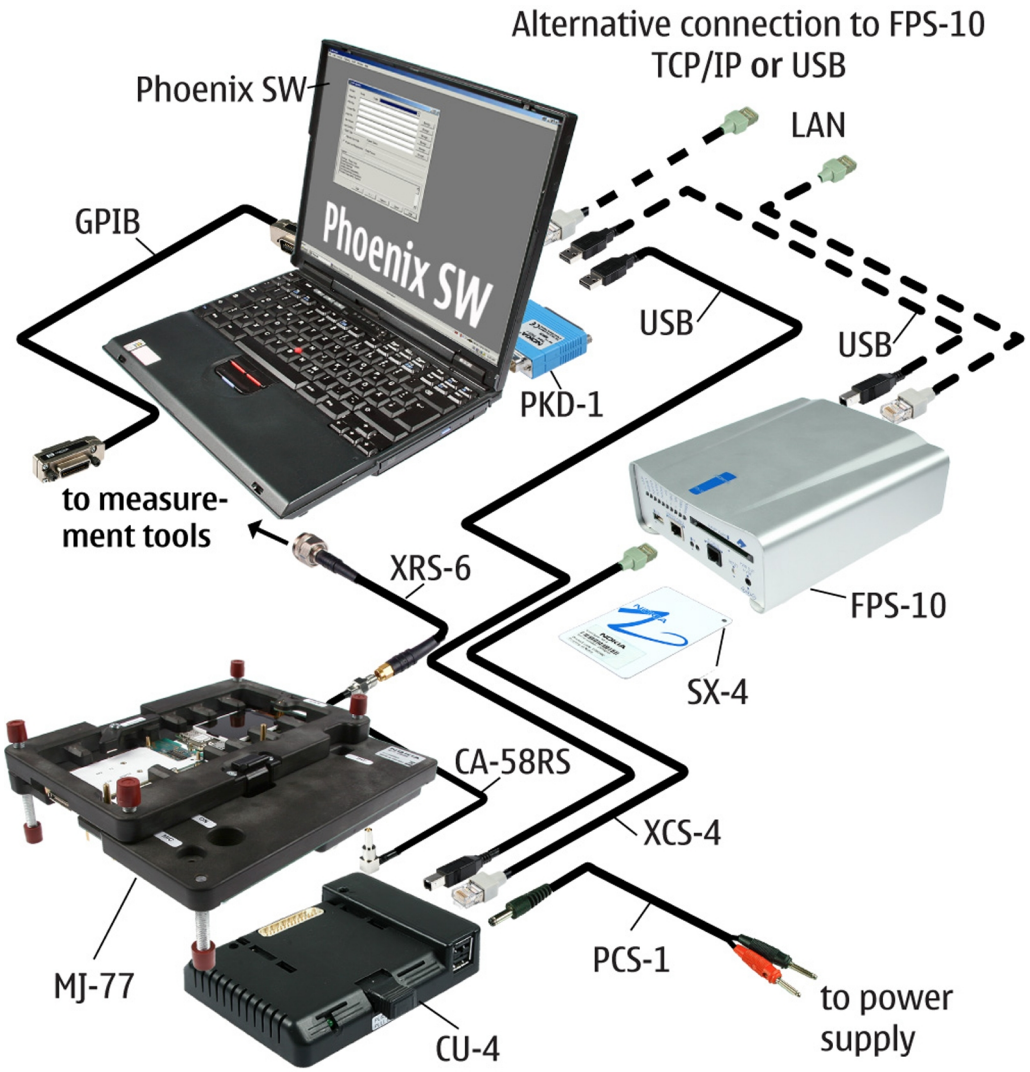


**Figure 30 MJ-77 module jig service concept**

| Type | Description |
|---|---|
| MJ-77 | Module jig |
| CU-4 | Control unit |
| FPS-10 | Flash prommer |
| SX-4 | Smart card |
| XCS-4 | Modular cable |
| PCS-1 | DC power cable |
| | Standard USB cable |
| | Standard USB cable |
| | GPIB control cable |
| XRS-6 | RF cable |


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| Type | Description |
|---|---|
| PKD-1 | SW security device |

## POS (Point of Sale) flash concept

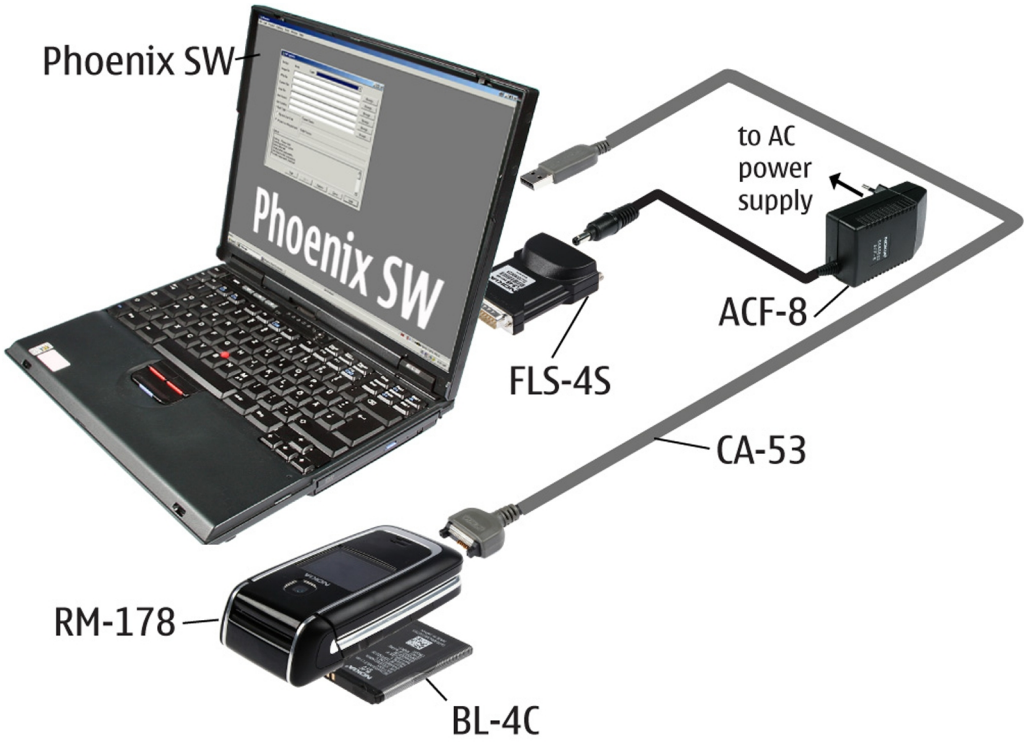


**Figure 31 POS flash concept**

| Type | Description |
|---|---|
| CA-53 | Cable |
| FLS-4S | POS flash dongle |
| ACF-8 | Power adapter |
| BL-4C | Battery |


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## Service concept for GSM, WCDMA, and WLAN RF testing and RF/BB tuning

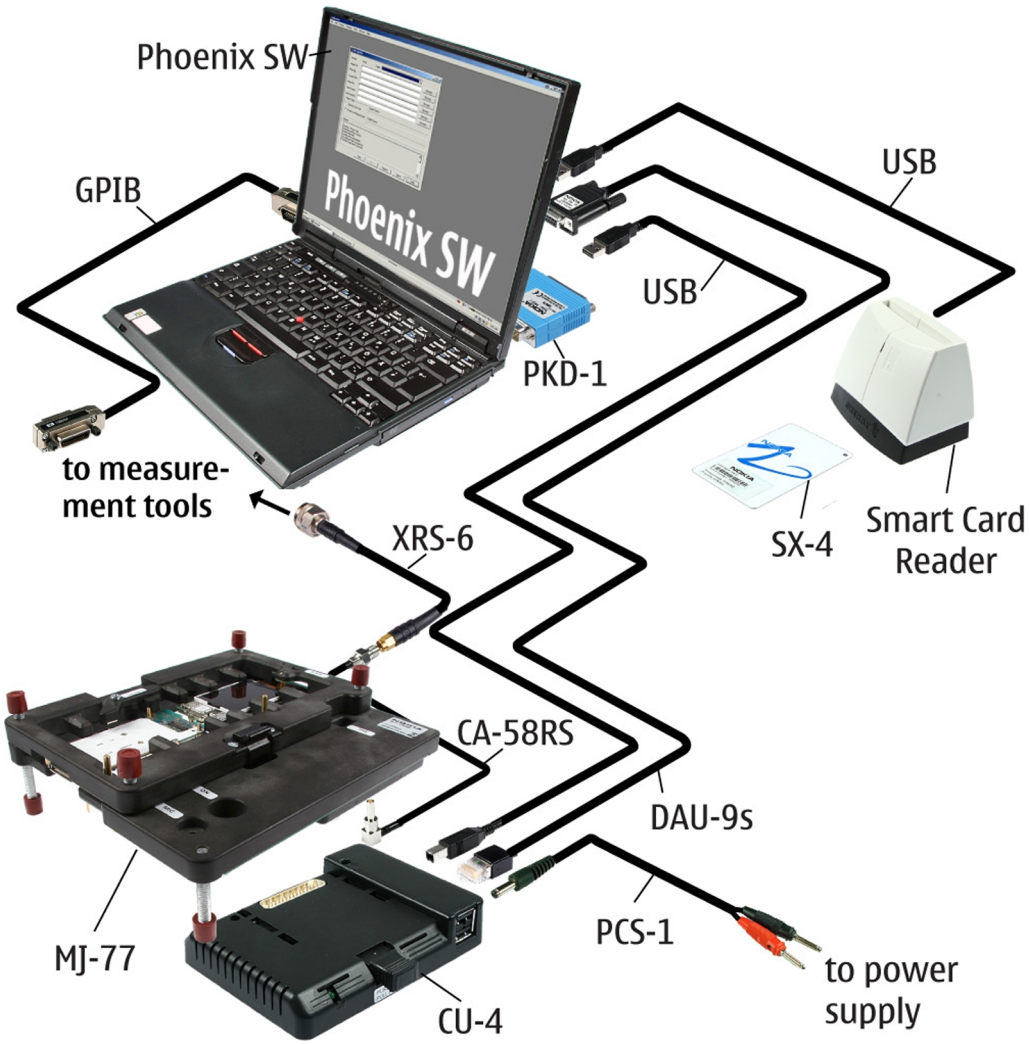


**Figure 32 Service concept for RF testing and RF/BB tuning**

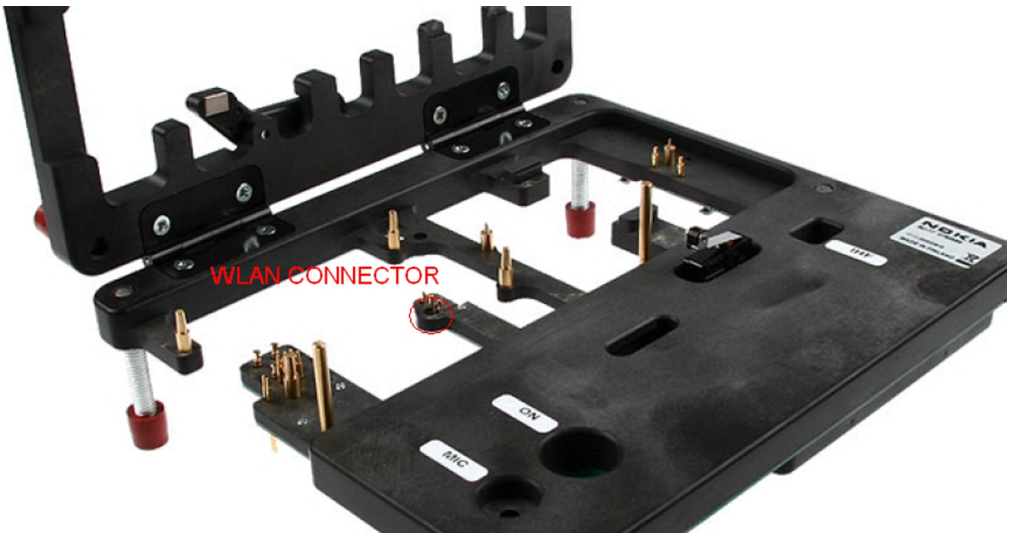


**Figure 33 WLAN connector in MJ-77 module jig**


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| Description | Type |
|---|---|
| MJ-77 | Module jig |
| CU-4 | Control unit |
| | Standard USB cable |
| PCS-1 | DC power cable |
| | Standard USB cable + smart card reader |
| SX-4 | Smart card |
| XRS-6 | RF cable |
| | GPIB control cable |
| PKD-1 | SW security device |

## CU-4 flash concept with FPS-10

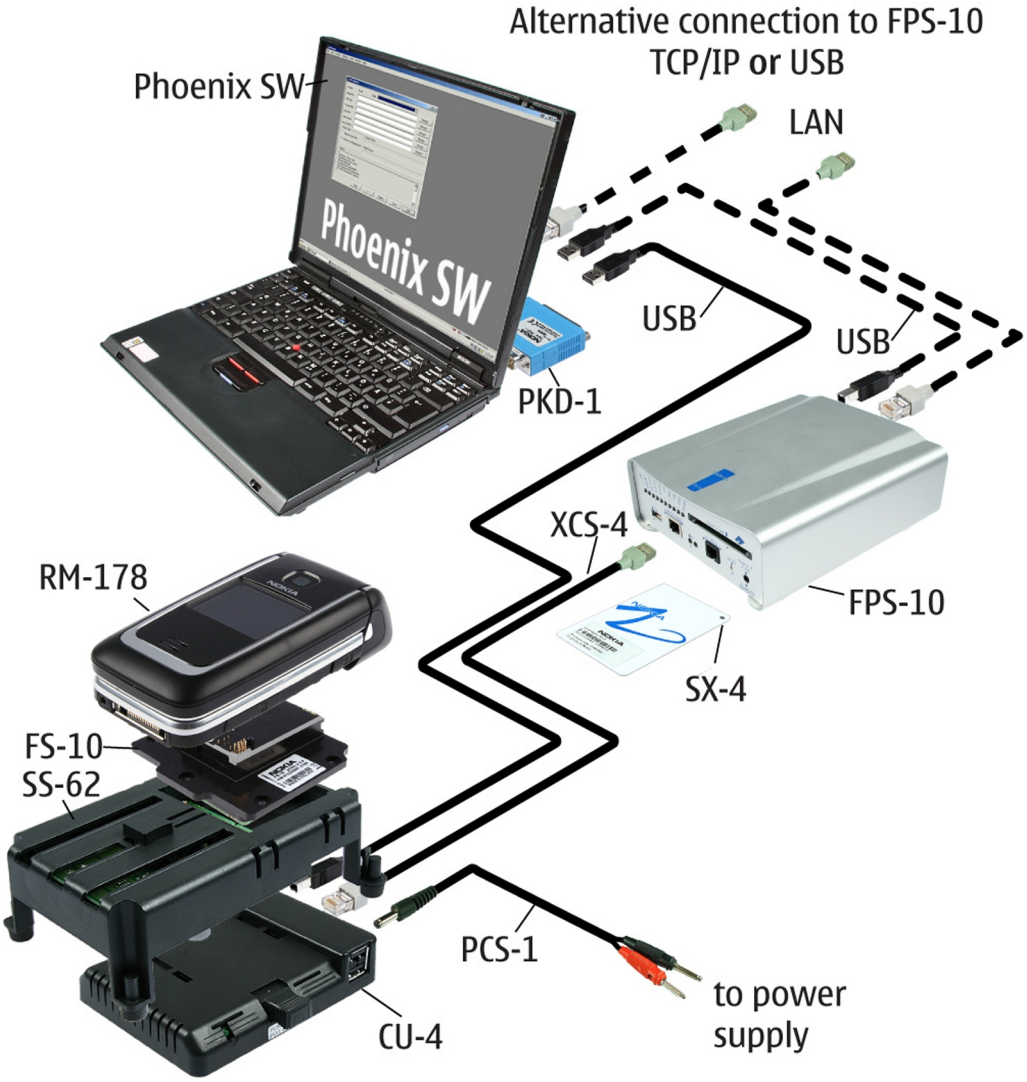


**Figure 34 CU-4 flash concept with FPS-10**


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| Description | Type |
|---|---|
| FS-10 | Flash adapter |
| CU-4 | Control unit |
| PCS-1 | Power cable |
| XCS-4 | Modular cable |
| FPS-10 | Flash prommer box |
| SS-62 | Jig |
| SX-4 | Smart card |
| | Standard USB cable |
| PKD-1 | SW security device |

## RF testing concept with RF coupler

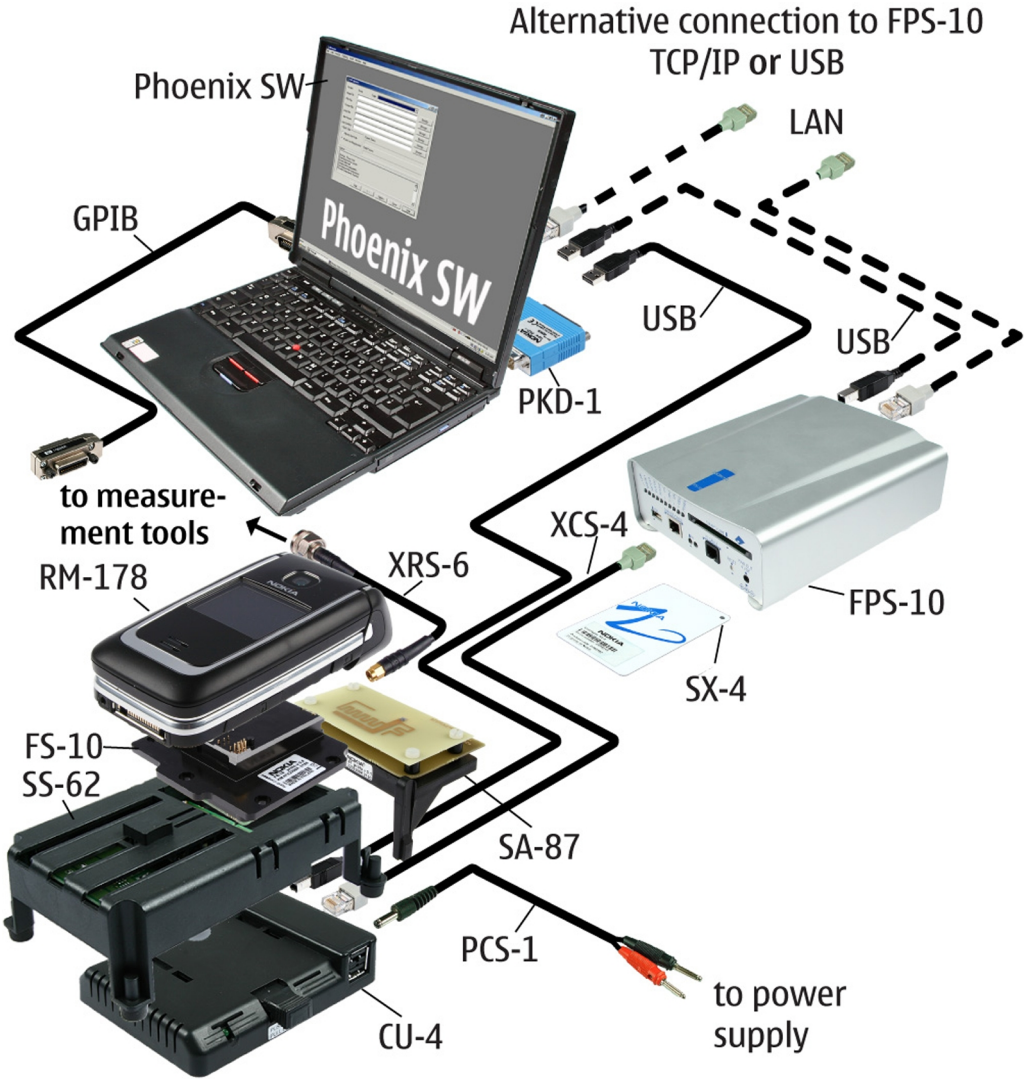


**Figure 35 RF testing concept with RF coupler**


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| Type | Description |
|---|---|
| FS-10 | Flash adapter |
| CU-4 | Control unit |
| SA-87 | RF coupler |
| PCS-1 | Power cable |
| XCS-4 | Cable |
| SS-62 | Jig |
| | Standard USB cable |
| | Standard USB cable + smart card reader |
| SX-4 | Smart card |
| | GPIB control cable |
| XRS-6 | RF cable |
| PKD-1 | SW security device |


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# 5 — Disassembly / Reassembly Instructions


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## Table of Contents

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Upper block assembly.....5–11
Lower block disassembly.....5–17
Lower block assembly.....5–23


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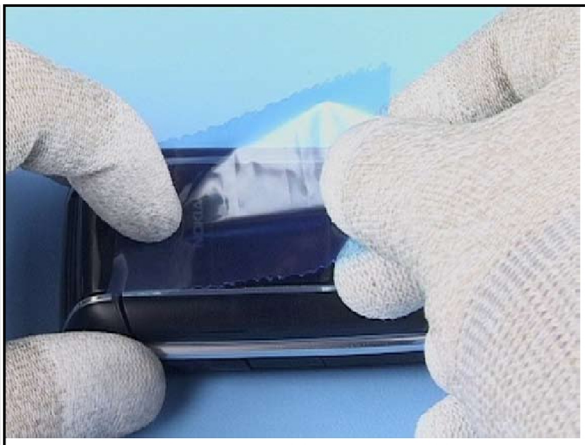
## Upper block disassembly

1. Needed tools



2. Cover the B-Upper Assembly window with protective film.

3. Unlock the Battery Cover and remove it.

4. The A-Cover Upper Bezel is glued down. Begin to release the adhesion with the SRT-6 as shown.

5. Open the unit.

6. Cover the LCD Window with protective film.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7. Complete the removal of the glued A-Cover Upper Bezel with the SS-93.

8. Ensure that no adhesive residue remains.

9. Unscrew the two screws in the order shown...

10. ... and remove them with tweezers.

11. Release the snaps of the B-Upper Assembly with the SRT-6.

12. Note the positions of the snaps.


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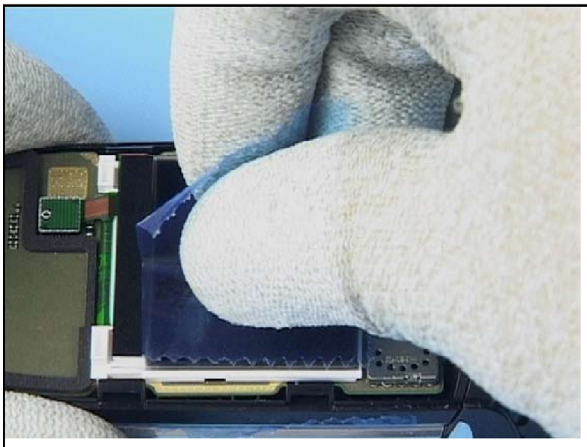
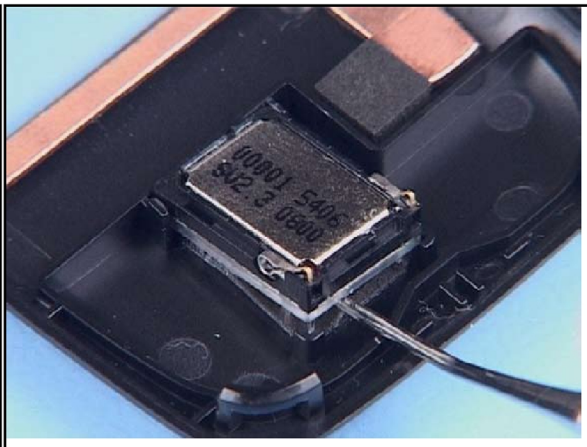
13. Note the positions of the snaps.

14. You can now remove the B-Upper Assembly.

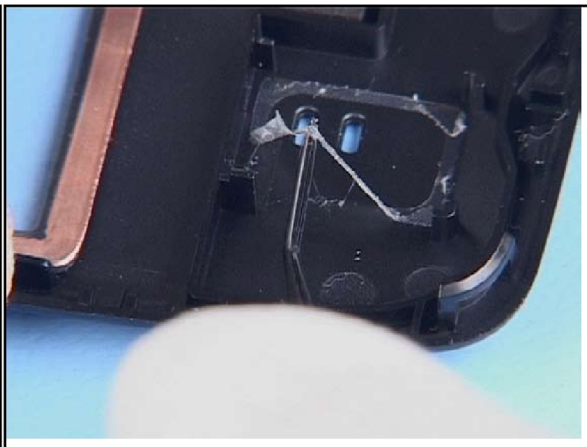


15. Cover the LCD PM with protective film.



16. Remove the IHF Speaker with the dental pick.

17. Remove the Donau Gasket with the dental pick. Do not reuse this gasket when re-assembling.



18. Remove all residual gasket adhesive.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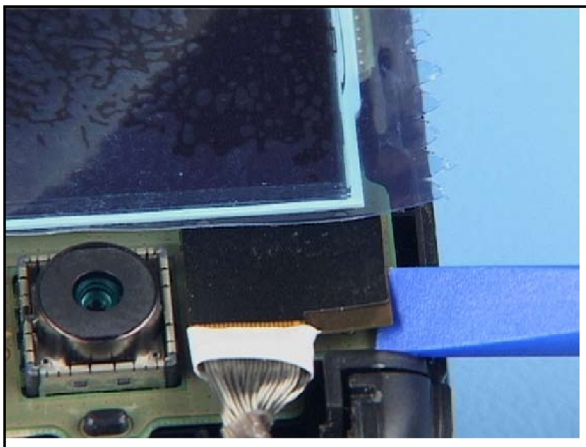
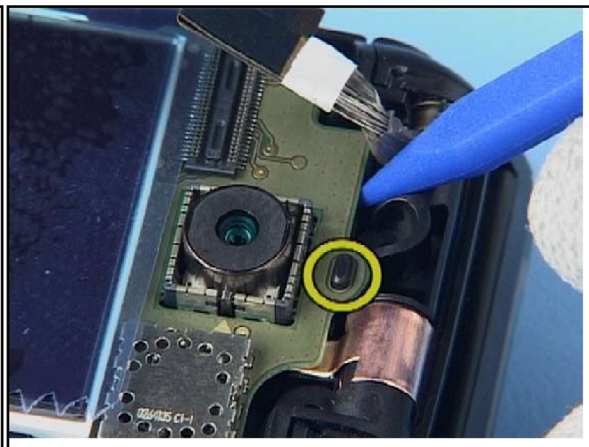
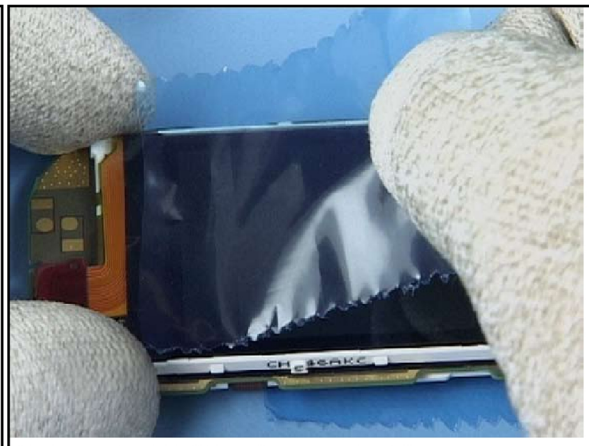


19. Open the Micro Coax Cable Assembly connector with the SS-93.

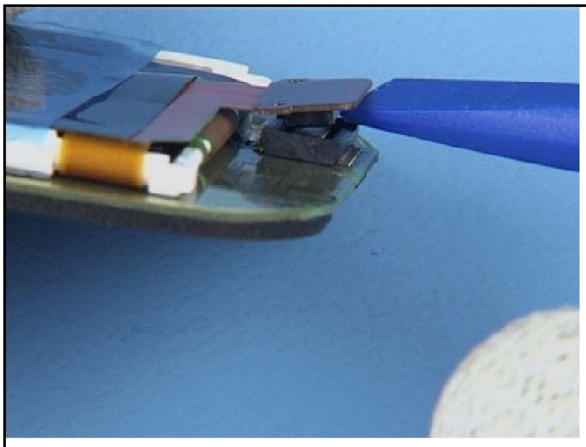


20. Lift up the UI-Module with the SS-93. Note the guide pin.

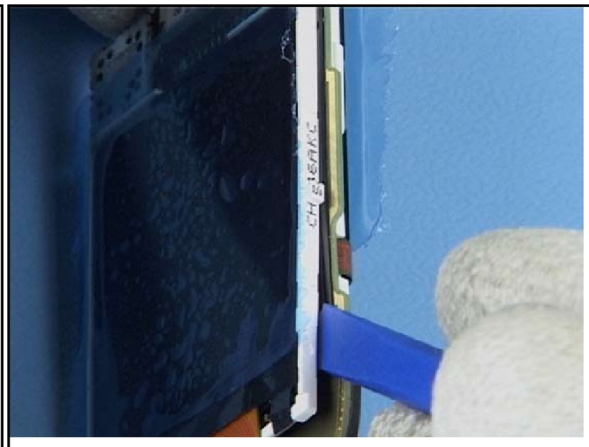
21. Remove the UI-Module and turn it over.



22. Cover the LCD AM with protective film.



23. Open the LCD AM connector with the SS-93.



24. The LCD AM is glued to the UI-Module. Use the SS-93 and start releasing the adhesive bond from the connector side.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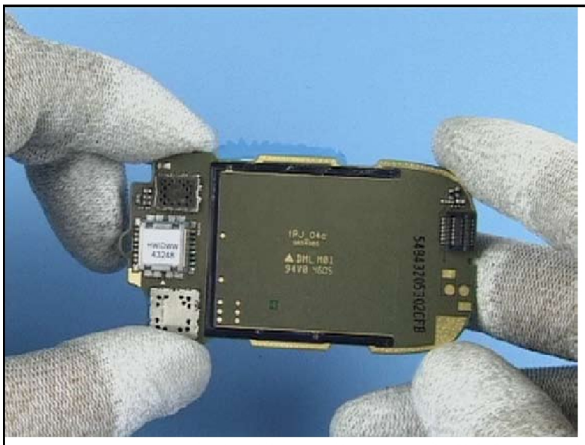
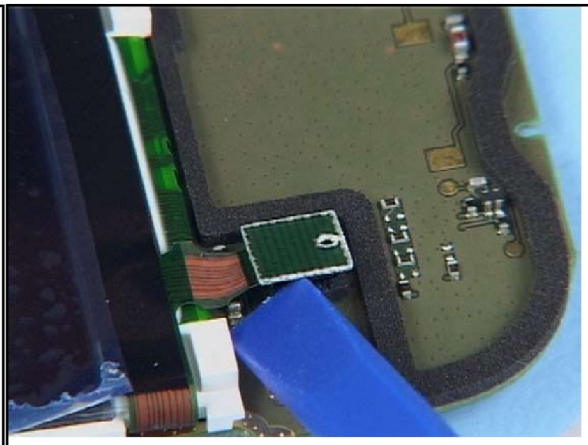
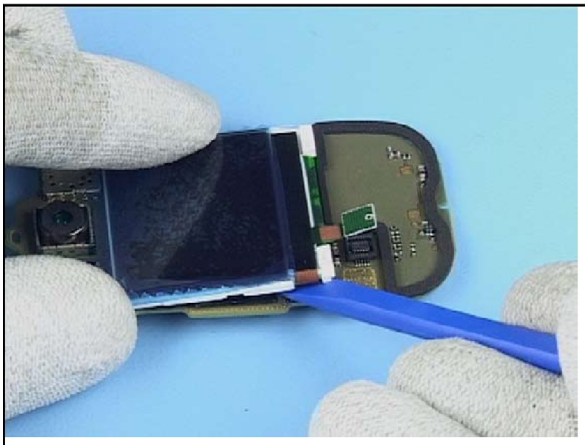


25. The SUEZ LCD Black Adhesive is reusable if it has not been damaged during the disassembly.

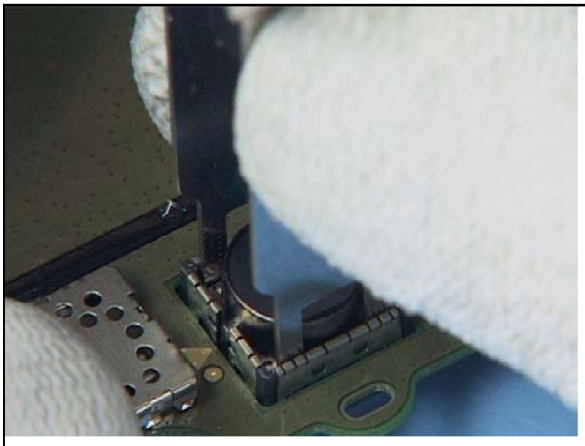


26. Open the LCD PM connector with the SS-93.



27. The LCD PM is glued to the UI-Module. Use the SS-93 and start releasing the adhesive bond from the connector side.

28. The NAXOS LCD Black Adhesive is also reusable if it has not been damaged during the disassembly.



29. Remove the Camera Module CCP2 with the SS-45 camera removal tool.

30. Remove the Earpiece with the dental pick.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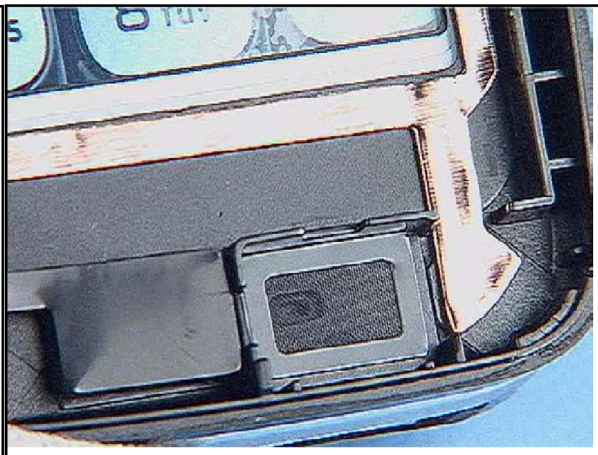
31. The Kirk Speaker Gasket is not reusable.



32. Ensure that the surface is clean of any adhesive residue.

33. The disassembly procedure is now complete.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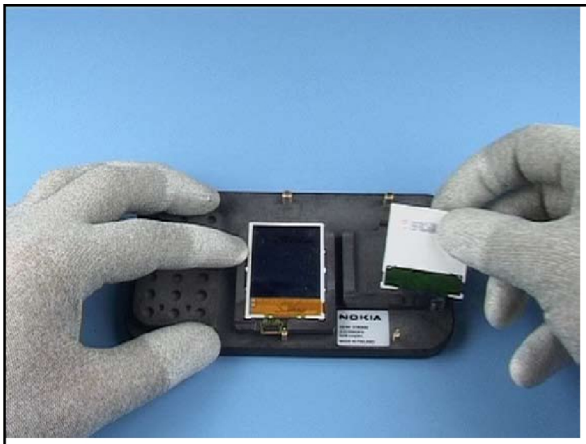
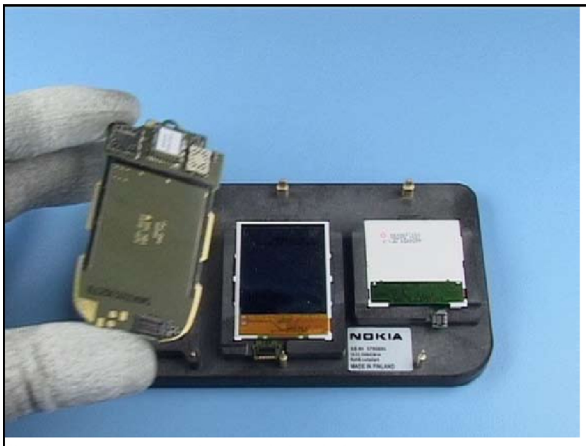
## Upper block assembly

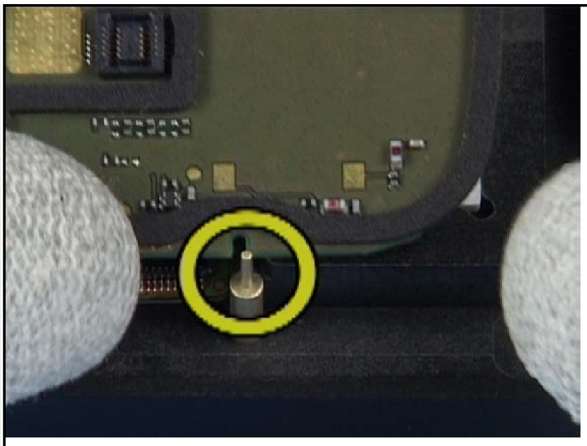
1. Needed tools.



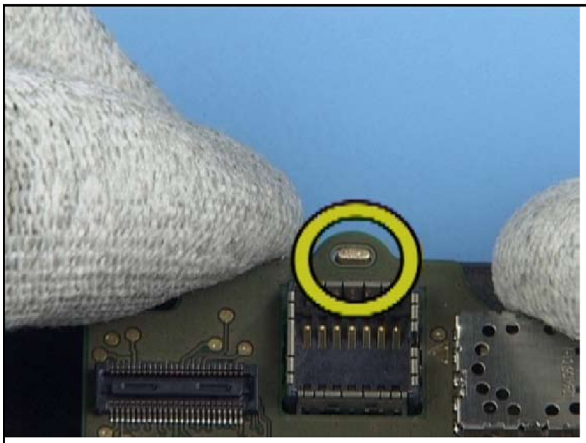
2. Place the LCDs AM and PM on the SS-84.



3. Then, starting with the LCD AM, ...



4. ... locate the PWB Rigid over the small guide pin on the SS-84.



5. Do not drop the PWB Rigid on to the LCD AM before the long guide slot is also aligned over the second guide pin on the SS-84.

6. When the PWB Rigid is in the correct positon, press it down on to the LCD AM.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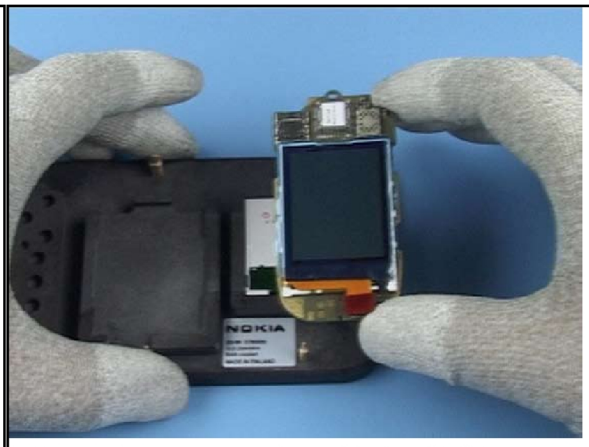
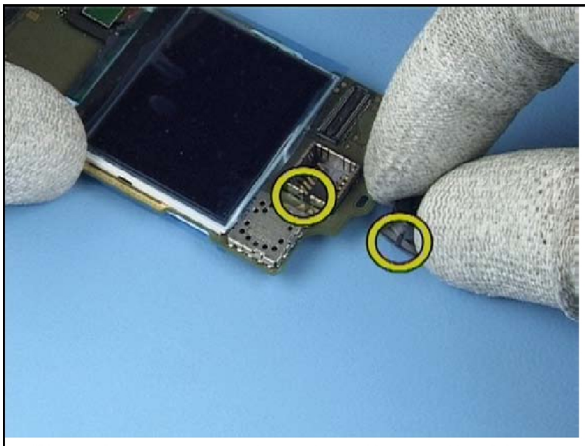
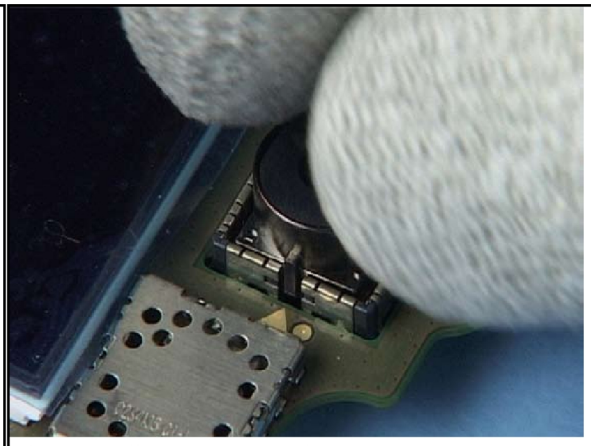
7. Remove the PWB Rigid include the LCD AM.



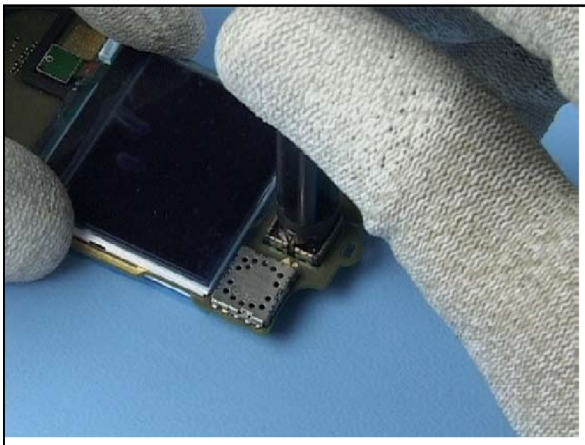
8. Repeat the same procedure with the LCD PM.



9. Check the correct position of the Camera Module...



10. ... place it into its connector.



11. ... and press it smoothly into place with the back of the SS-45 camera removal tool.

12. Remove the protective film from the LCD AM.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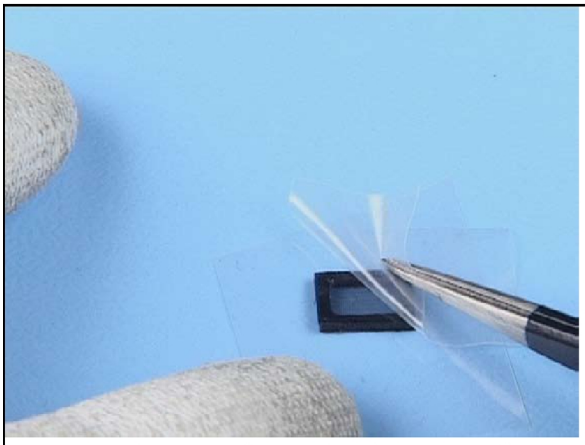
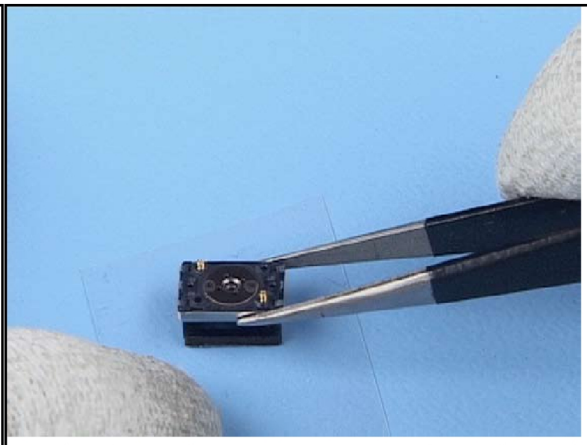
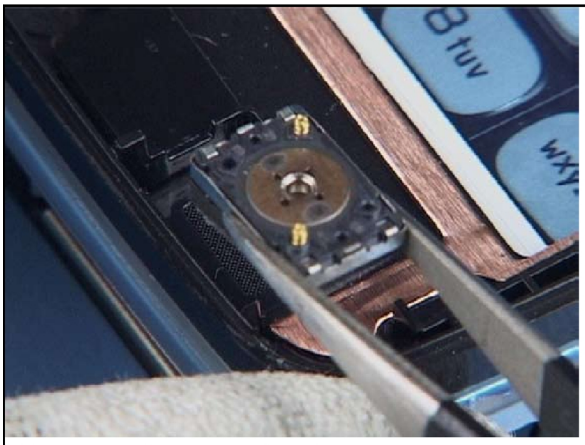


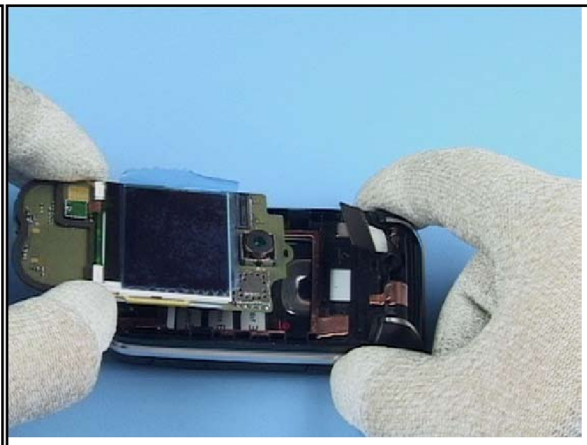
13. Remove the protective coating from a new Kirk Speaker Gasket.



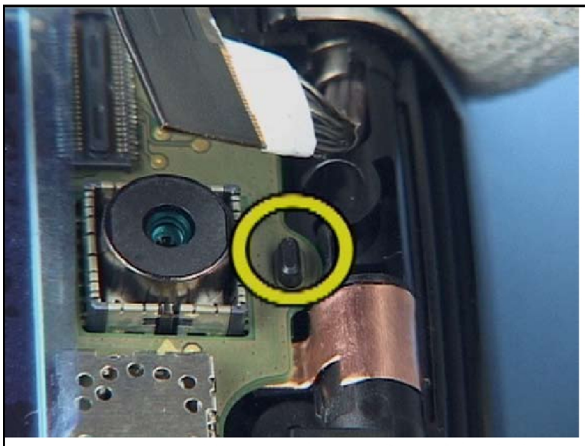
14. Align the Earpiece exactly over the Kirk Speaker Gasket and apply light pressure.




15. Place the Earpiece and gasket assembly into its housing in the A-Cover.



16. Place the UI-Module in the A-Cover Assembly.



17. Start the assembly procedure at the guide pin located by the Hinge Module.

18. Close the Micro Coax Cable Assembly connector with your finger.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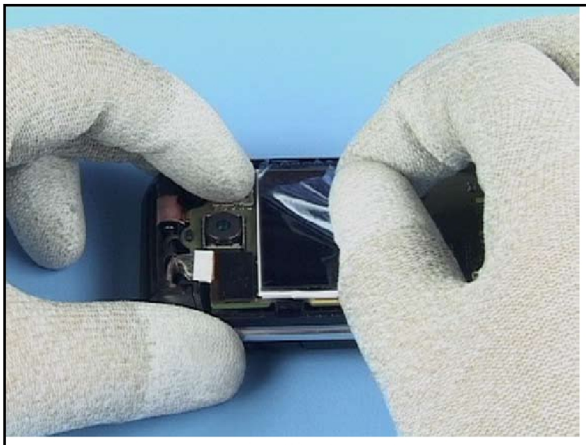
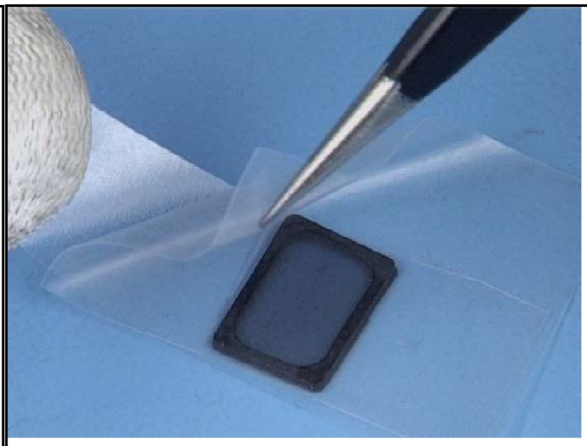
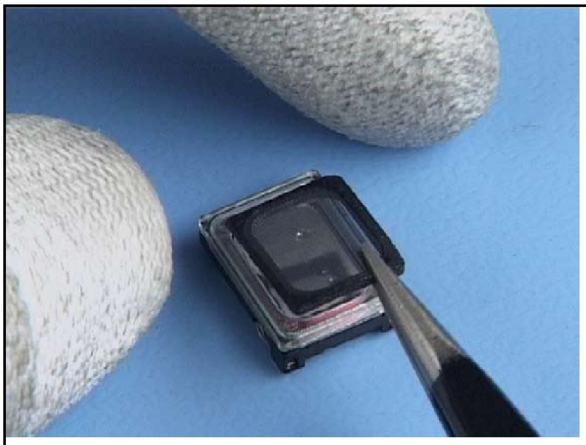


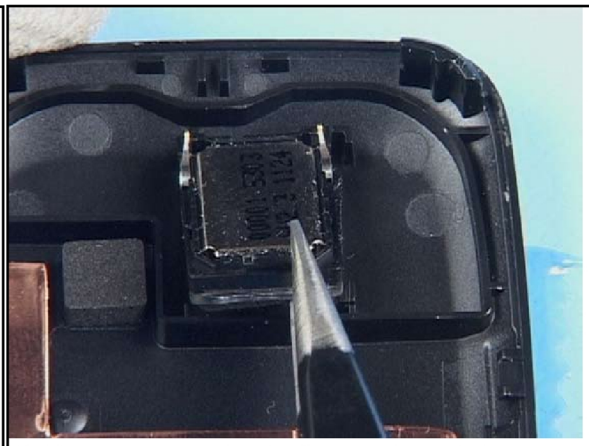
19. Remove the protective film from the LCD PM.



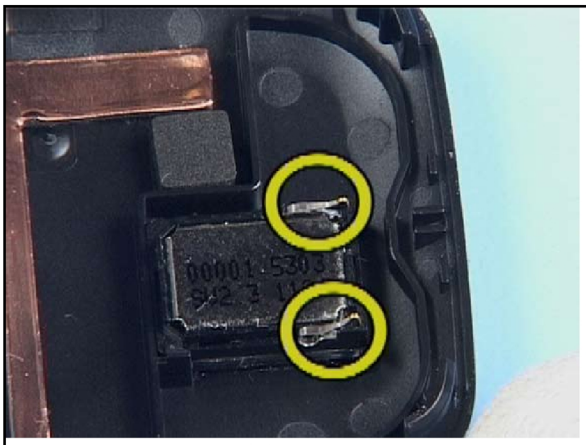
20. Take a new Donau Gasket and remove the protective coating.



21. Carefully position the Donau Gasket on the IHF Speaker.



22. Place the assembly in its housing in the B-Upper Assembly.



23. Note the direction of the IHF Speaker contact pins.

24. Place the B-Upper Assembly on the A-Cover Upper Assembly.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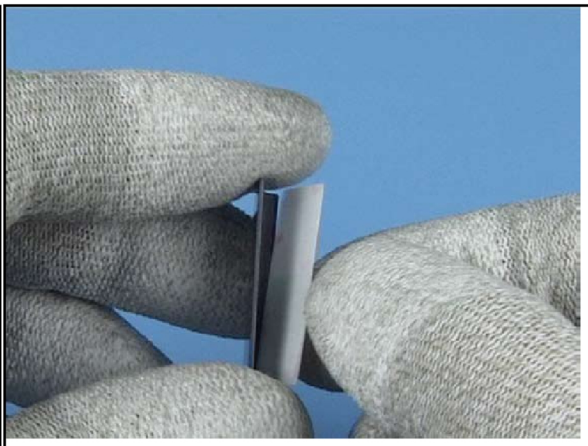
25. Start the assembly procedure at the pop port connector end.

26. Close all the snaps and check that there are no gaps remaining.

27. First insert the two screws with tweezers.

28. Set the correct torque.

29. To avoid damaging the plastic threads, first turn the screws left to engage the thread and then tighten them lightly. Then, apply the correct torque in the order shown.



30. Take a new A-Cover Upper Bezel and remove the protective coating.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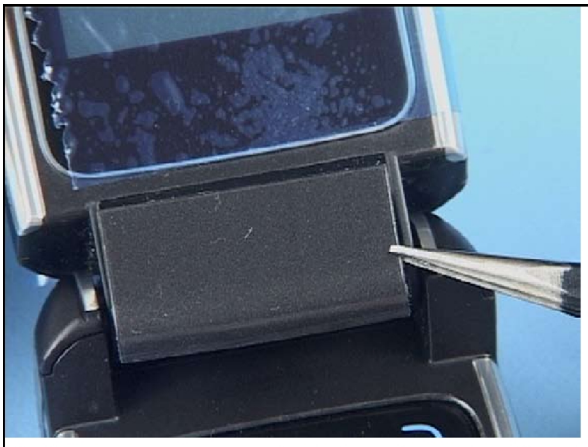
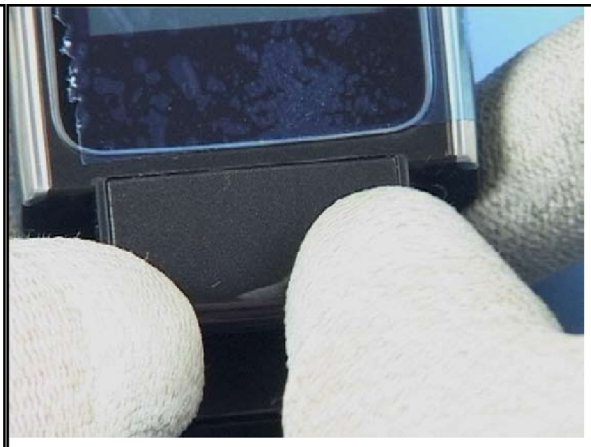


31. Use tweezers to work the A-Cover Upper Bezel into its correct position on the B-Upper Assembly...



32. ... and smooth it down with your fingers.

33. Remove the protective film from the LCD Window.

34. Check the window for cleanliness.

35. Complete the assembly by fitting the Battery Cover Assembly.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## Lower block disassembly

1. Needed tools.

2. Cover the B-Upper Assembly window with protective film.

3. Unlock the Battery Cover and remove it.

4. Cover the LCD Window with protective film.

5. Release the snaps on the left side of the Antenna Cap with the SRT-6.

6. Turn the phone over and release the snap in the middle.


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7. Remove the Antenna Cap...

8. ... and check the condition of the snaps.

9. Unscrew the four screws in the order shown.

10. Remove the screws and discard them. These screws cannot be reused after disassembly.

11. First, use the SS-93 to release the snap of the C-Cover Assembly on the Memory Card Door side.

12. As the snap is released, the Memory Card Door automatically falls out and can be placed on one side.


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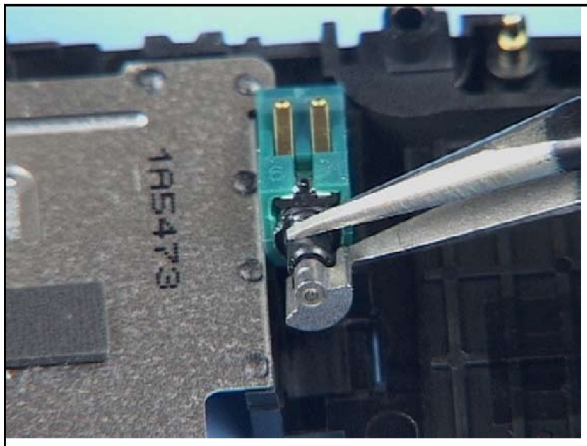
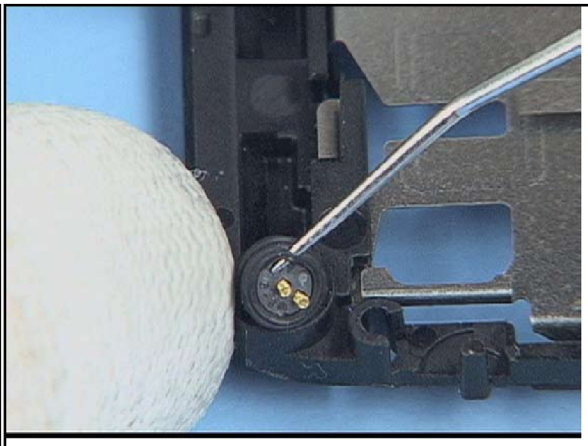
13. Now open the snap on the opposite side of the C-Cover Assembly.

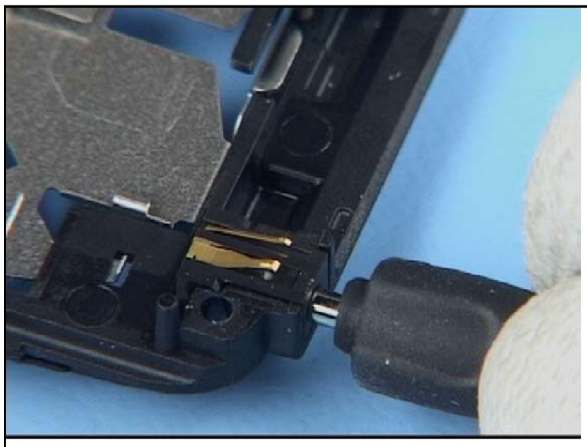
14. Remove the C-Cover Assembly starting from the Pop-Port Connector end.



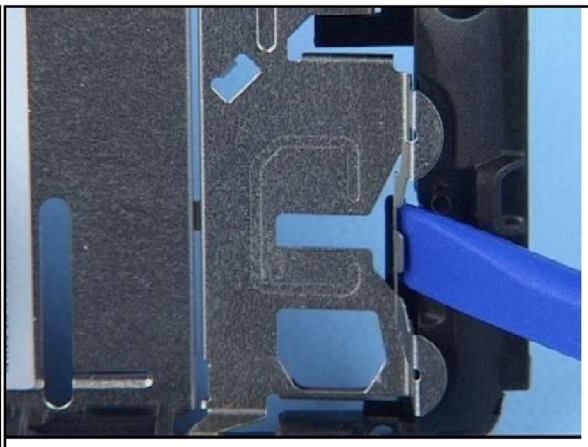

15. Lift out the Vibra Motor with tweezers.



16. Remove the Microphone with the dental pick.



17. Use the DC plug to remove the DC Jack.



18. First open the SIM Lid with the SS-93 ...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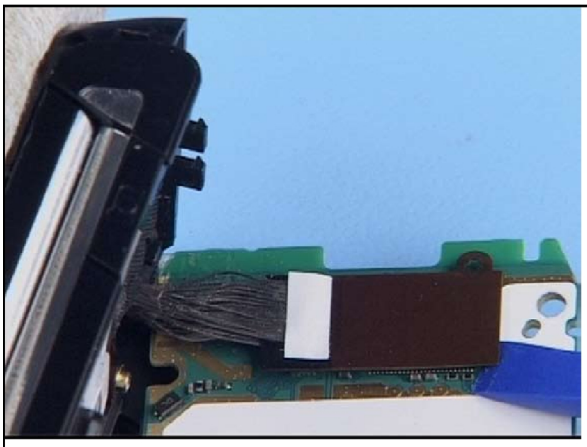
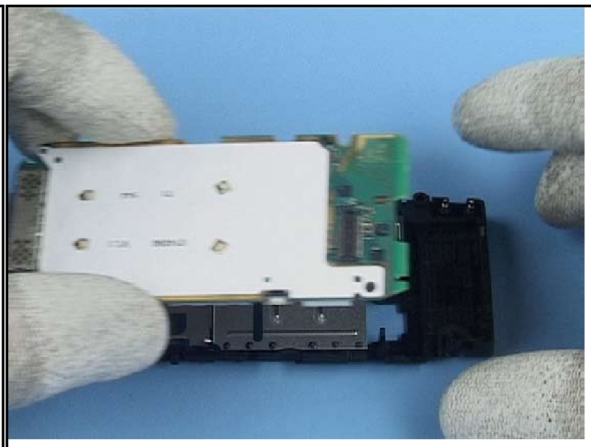
19. ... and then flex it slightly to release one end. It can now be removed.

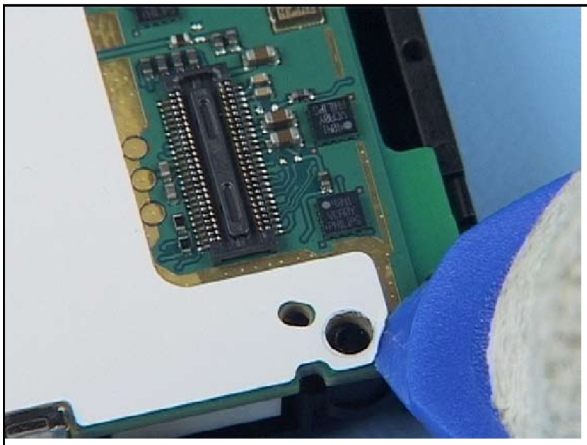
20. Raise the Engine Module slightly at the Pop-Port Connector end and then open it bookwise to a perpendicular position.



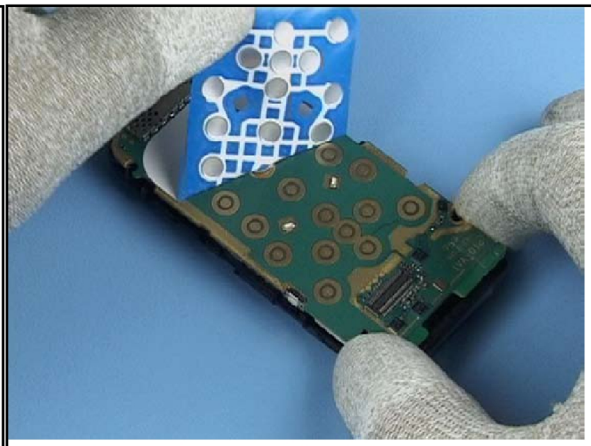
21. Hold the Engine Module in position and open the Micro Coax Cable Assembly connector with the SS-93.



22. Now remove the Engine Module and place it on the C-Cover Assembly.



23. Use the SRT-6 to peel up the Domesheet at one corner.



24. Now peel the Domesheet from the Engine Module and check the surface for adhesive residues.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25. Turn the phone over and the Keymat drops out easily.

26. Remove the A-Lower Net with tweezers and discard it.

27. Locate the small hole over the hinge in the A-Cover Assembly and insert the SS-6 as shown

28. Pushing down on the tool will release the hinge.

29. Hold the spring-loaded hinge pin down with your thumb while slowly separating one side of the hinge.

30. When separating the two parts, be very careful not to damage the Micro Coax Cable Assembly connector.


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31. The disassembly procedure is now complete.


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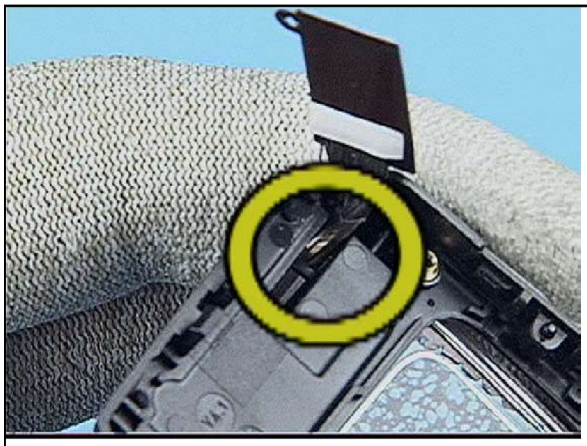
## Lower block assembly

1. Needed tools.

2. Feed the Micro Coax Cable Assembly connector through the slot in the A-Cover Assembly.



3. Be sure that the cable is correctly routed.

4. Depress the end of the Hinge Module and connect the parts. Ensure that the Hinge Module expands completely.

5. Place the Keymat in the A-Cover Assembly.

6. Check its correct position and orientation.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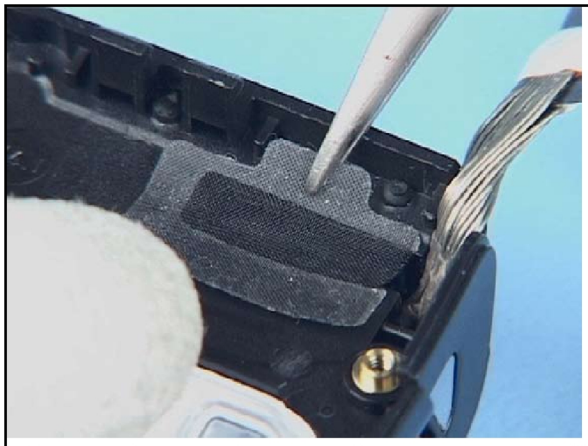
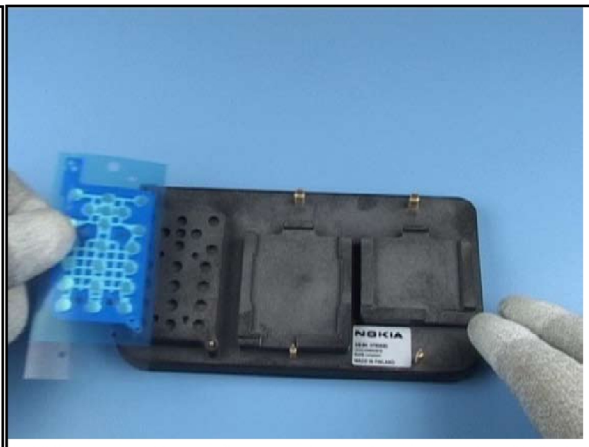
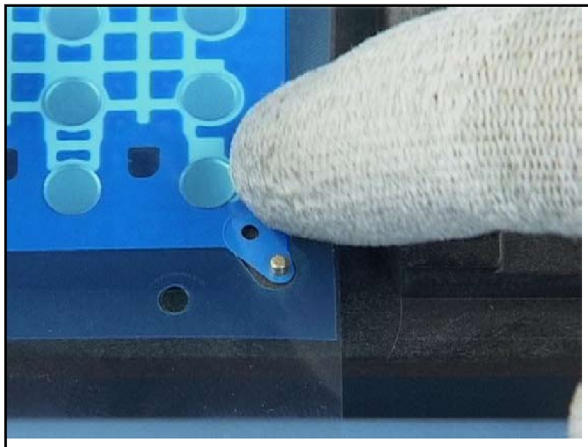


7. Remove the protective coating from a new A-Lower Net and smooth it into its position in the A-Cover Assembly.

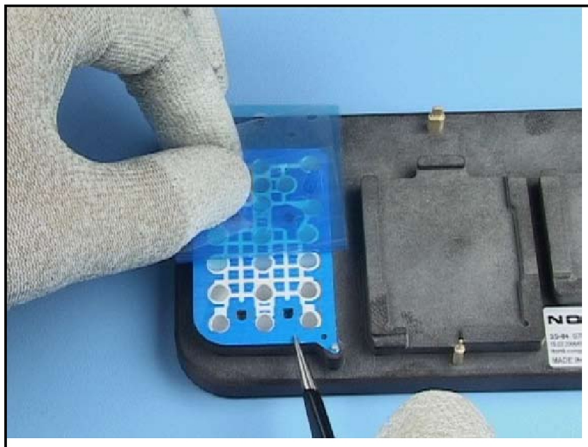


8. Take a new Domesheet and position it on the SS-84 Domesheet and Display Assembly Jig.

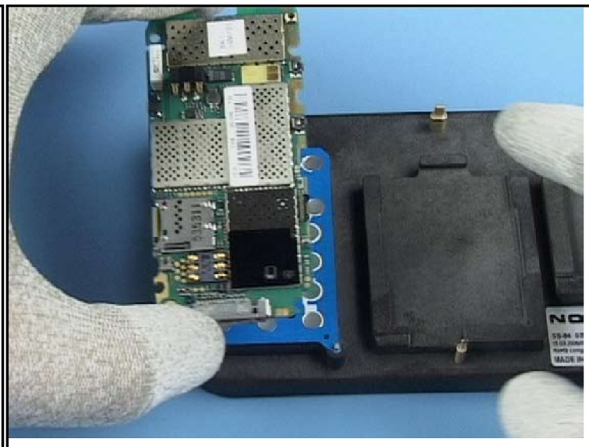


9. There are guide pins in the lower right ...

10. ... and upper left corners of the domesheet sectio



11. Remove the protective film of the new Domesheet with the help of tweezers.



12. Now position the Engine Module, with the correct side up, over the Domesheet but do not let them come into contact.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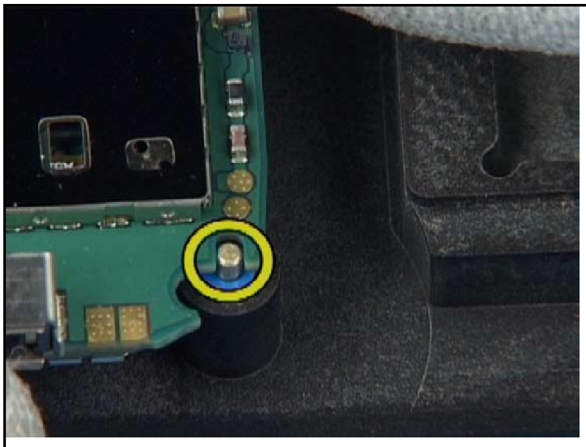
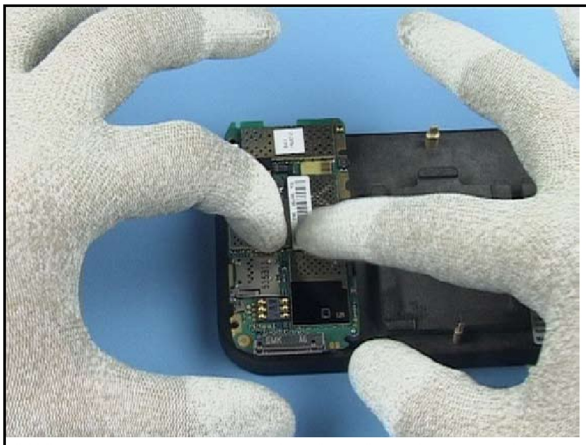
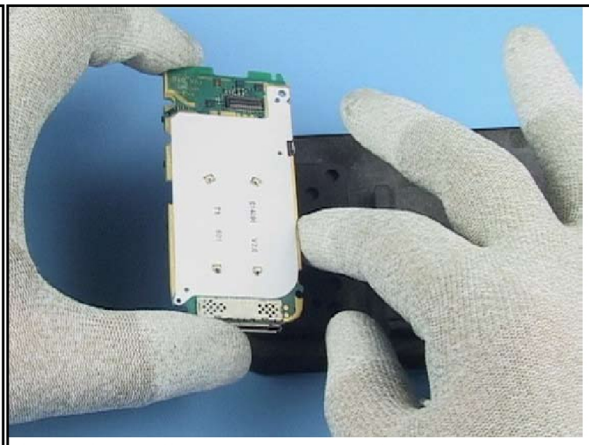


13.First, locate the Engine Module over the guide pin in the lower right ...

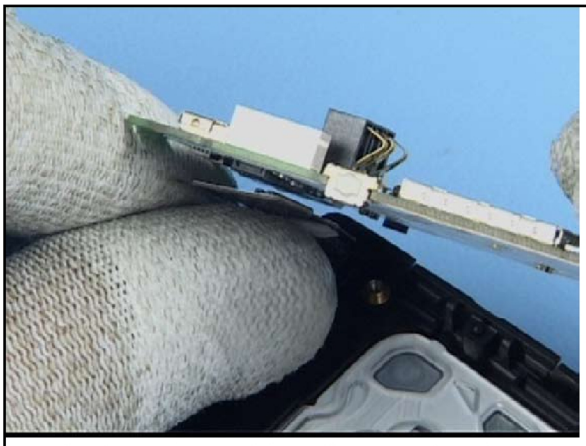
14. ... and then in the upper left corner.



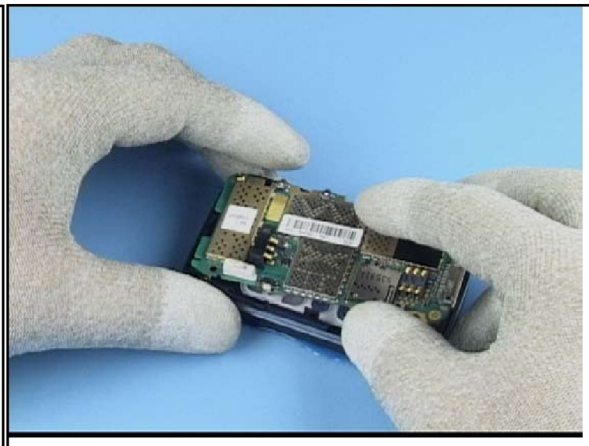
15. You can now press the Engine Module on to the Domesheet and remove the assembly.



16. Finally check the correct positioning of the Domesheet on the Engine Module



17. Take the Engine Module and connect the Micro Coax Cable Assembly connector.



18. Fold the Engine Module over on to the A-Cover Assembly.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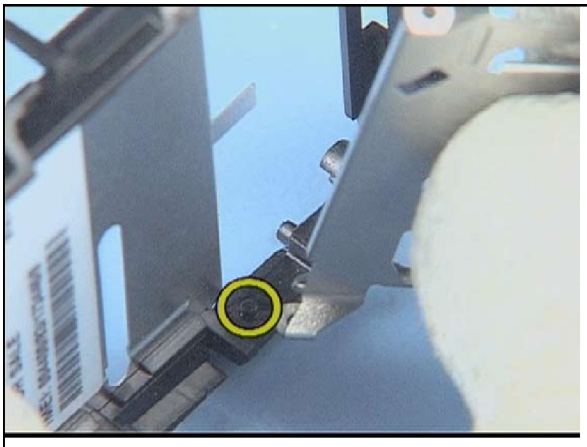
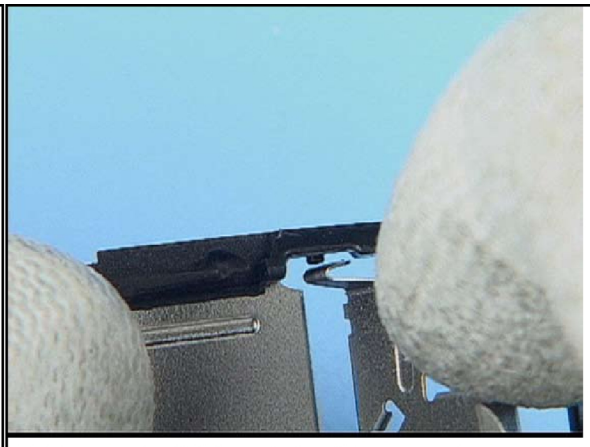
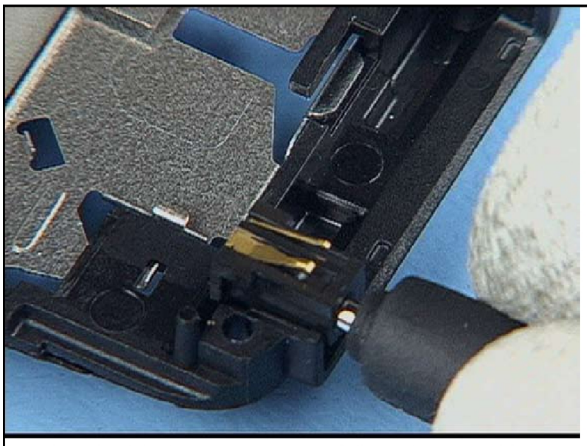


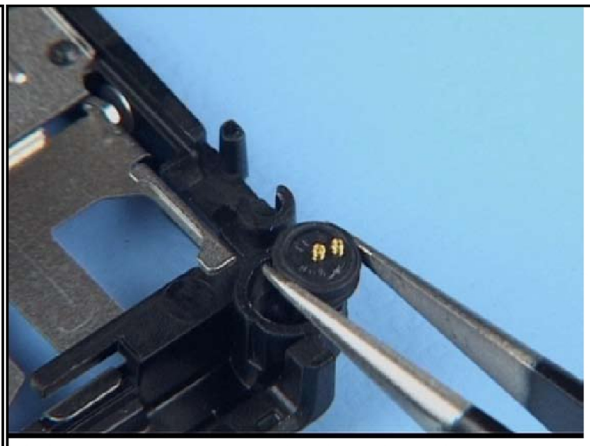
19. Place one end of the SIM Lid into position on its guide pin in the C-Cover Assembly.



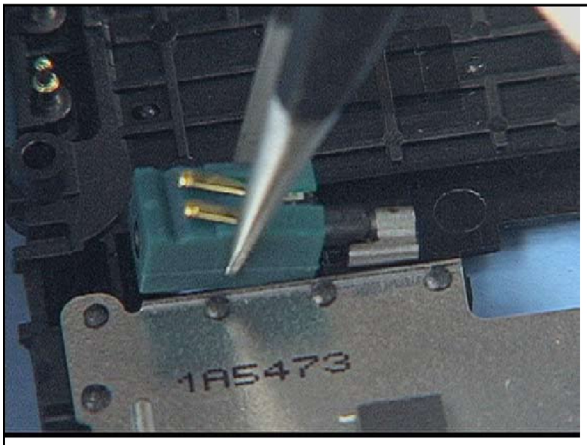
20. Flex the the SIM lid a little, slide it over the other pin and close it.



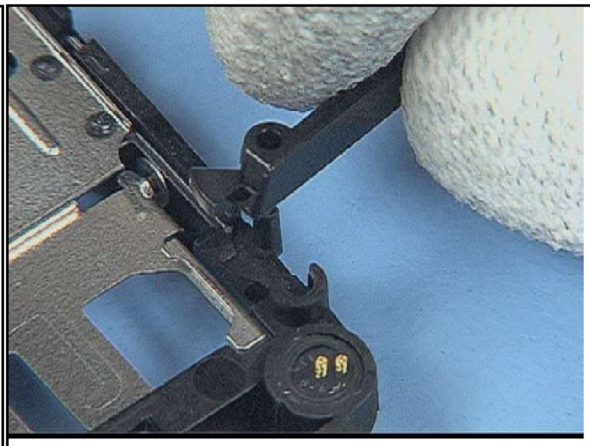
21. Use the DC plug to place the DC Jack into position.



22. Use tweezers to place the Microphone into its housing and press it into position.




23. Place the Vibra Motor into its housing and press it into position.



24. Assemble the Memory Card Door and leave it open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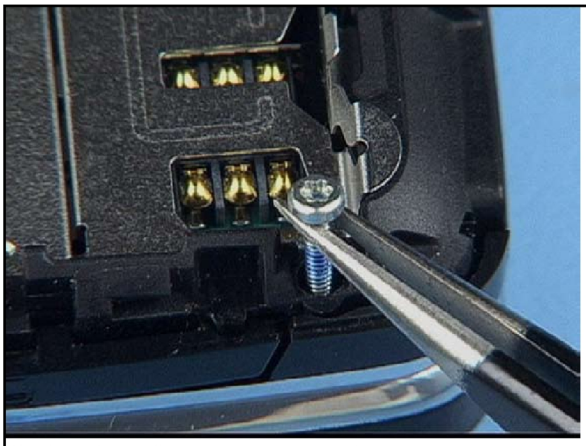
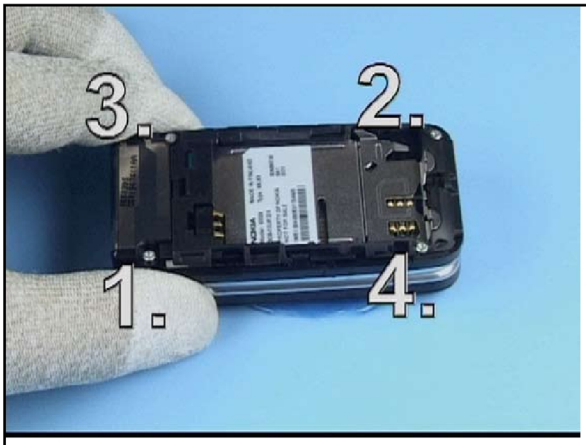
25. Take the unit and place it on to the C-Cover Assembly.

26. Turn the phone over and close the Memory Card Door.



27. First insert four new screws with tweezers.

28. Set the correct torque.




29. Tighten the four screws in the order shown.

30. Put the Antenna Cap into position and close the snaps on both sides.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31. Turn the phone over and close the snap on the back.

32. Remove the protective film from the LCD Window.

33. Check the window for cleanliness.

34. Complete the assembly by fitting the Battery Cover Assembly.

35. The assembly procedure is now complete.


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# 6 — BB Troubleshooting and Manual Tuning Guide


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## Baseband troubleshooting

### Context

This section is intended to be a guide for localising and repairing electrical faults. The fault repairing is divided into troubleshooting paths.

The following main troubleshooting tree describes the different baseband troubleshooting paths to be followed in fault situations.


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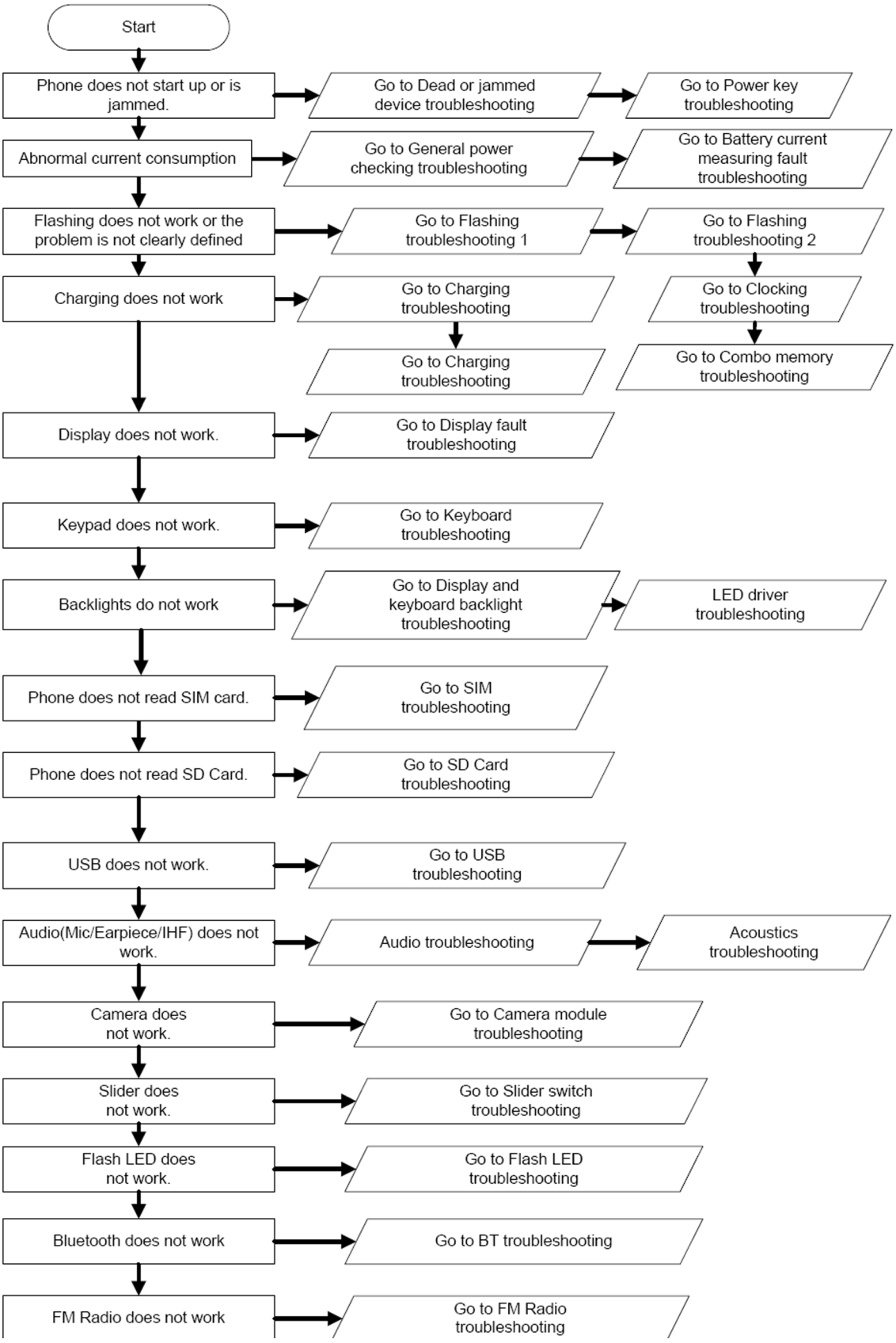
## Troubleshooting flow





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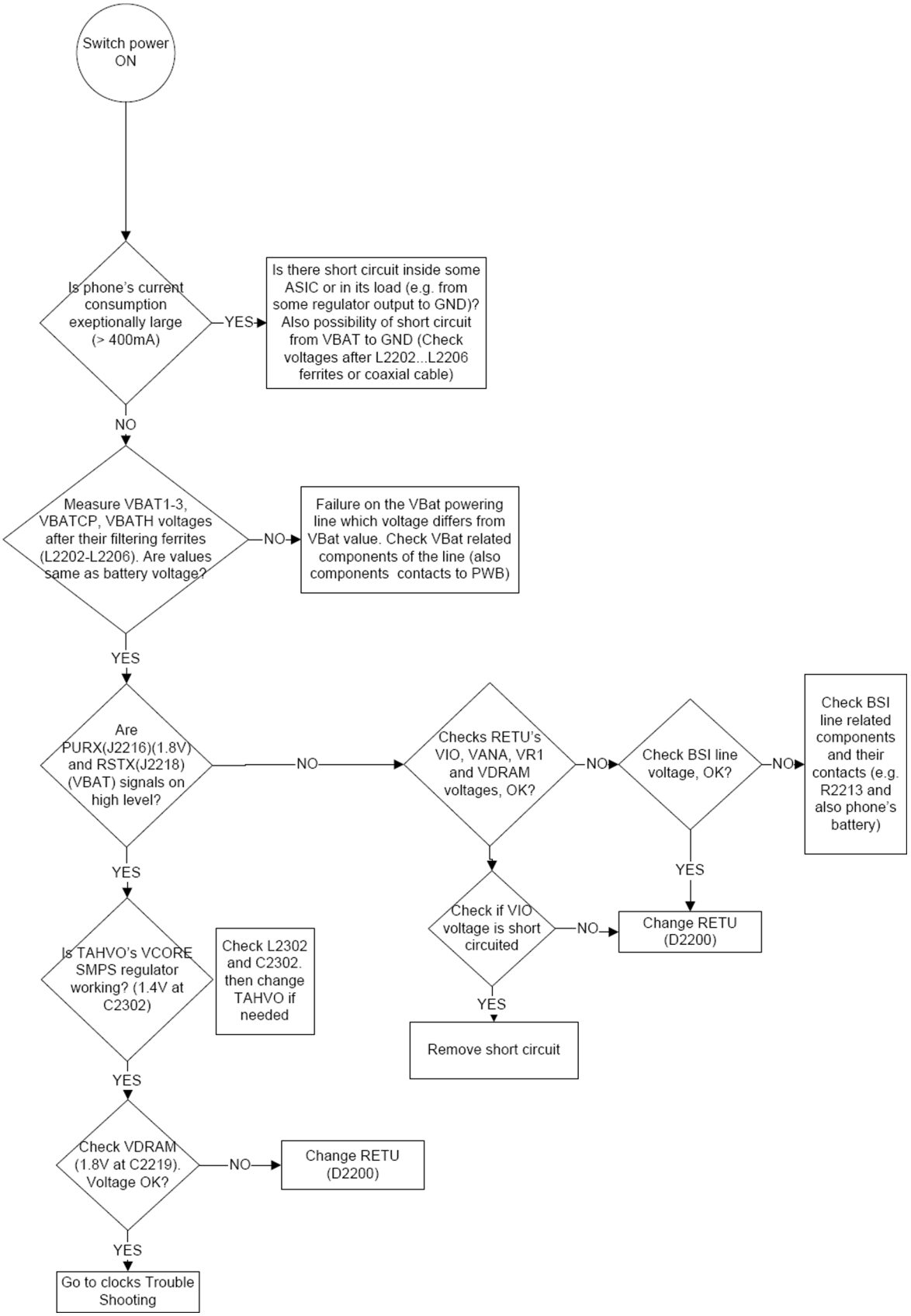
## General power checking troubleshooting

### Troubleshooting flow





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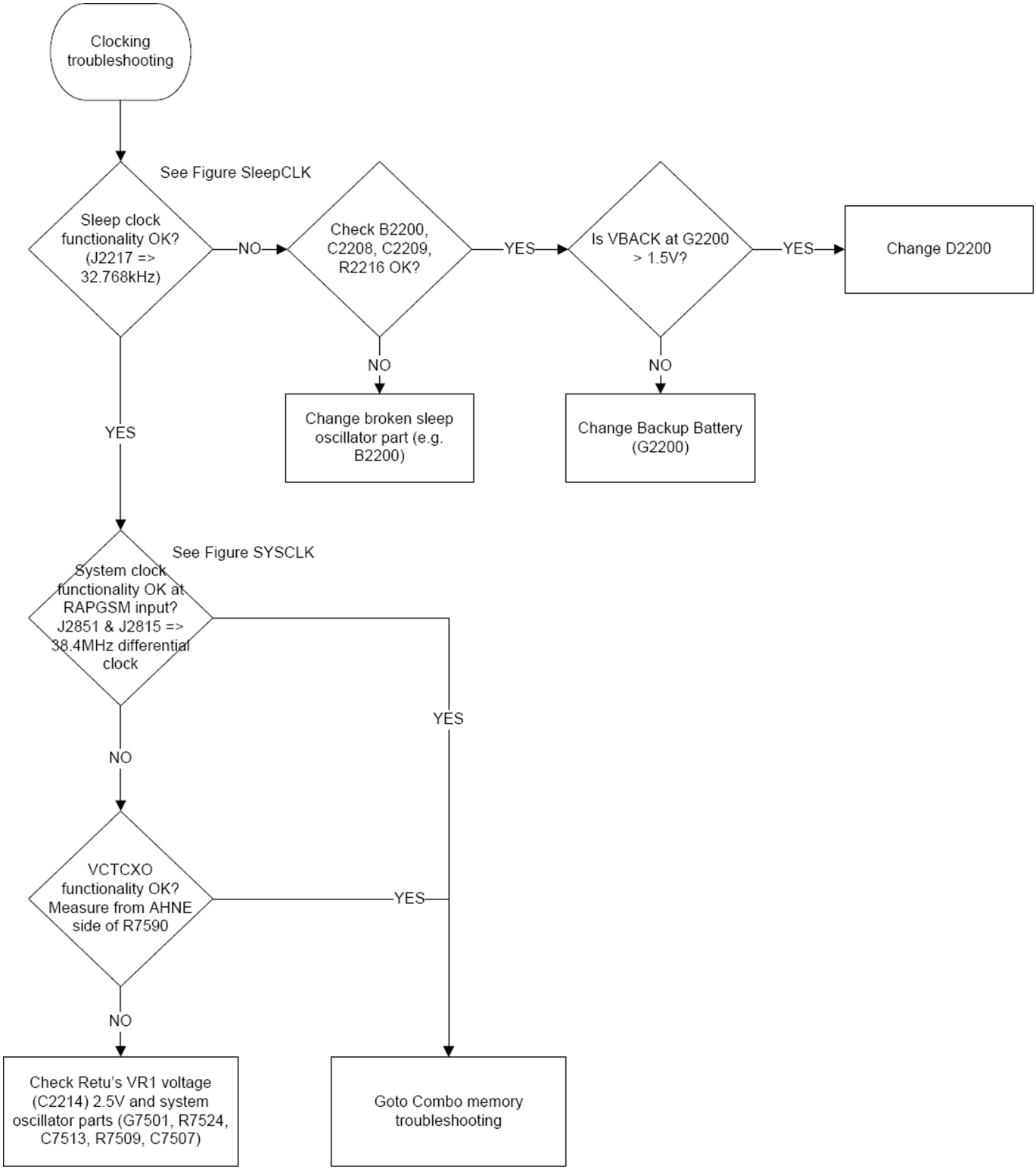
## Clocking troubleshooting

### Troubleshooting flow





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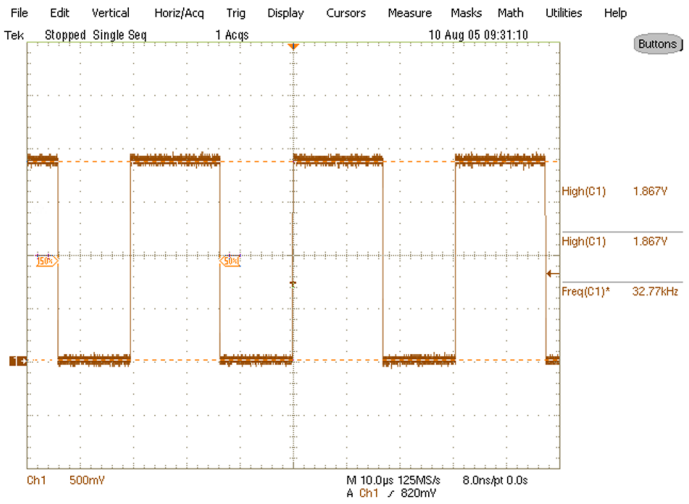


**Figure 36 SleepCLK**

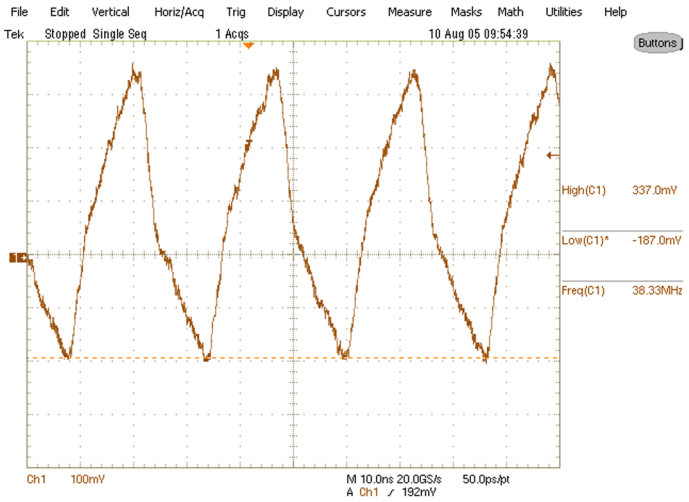


**Figure 37 SYSCLK**


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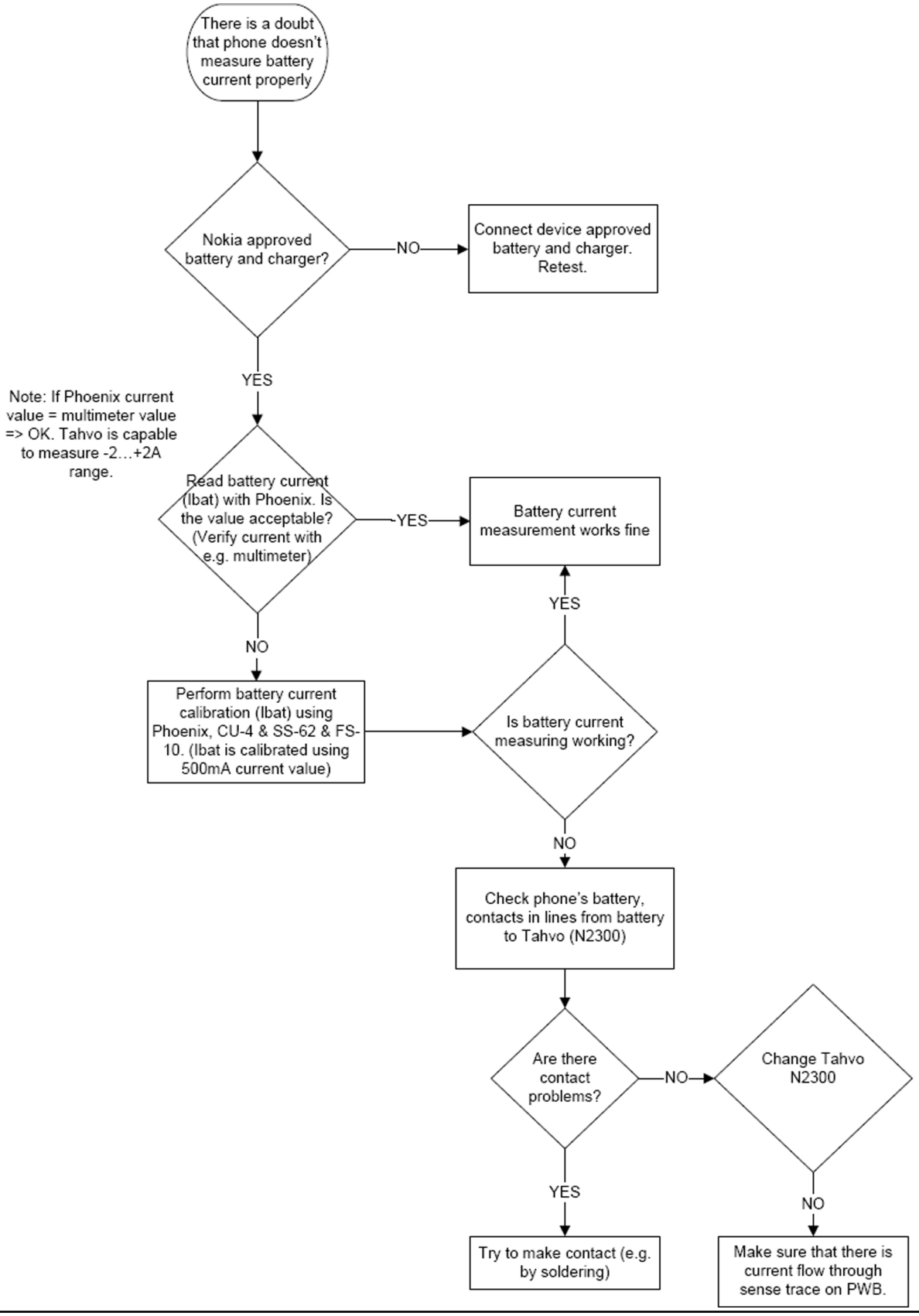
## Battery current measuring fault troubleshooting

### Troubleshooting flow





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## Flash programming fault troubleshooting

### Troubleshooting flow

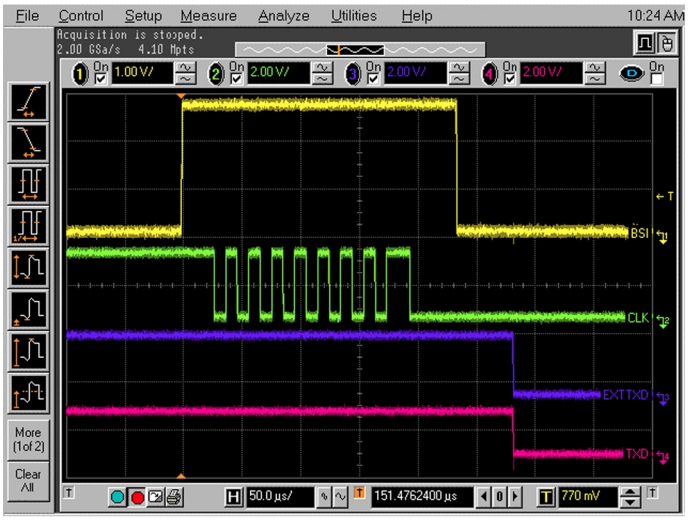


**Figure 38 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.**

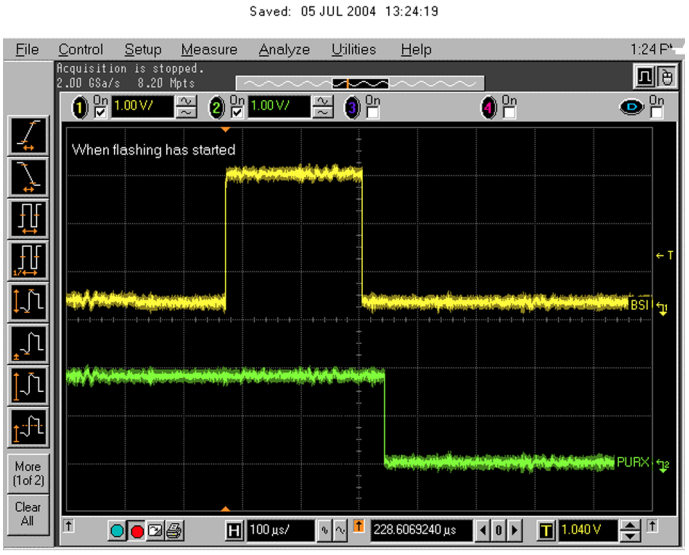


**Figure 39 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.**


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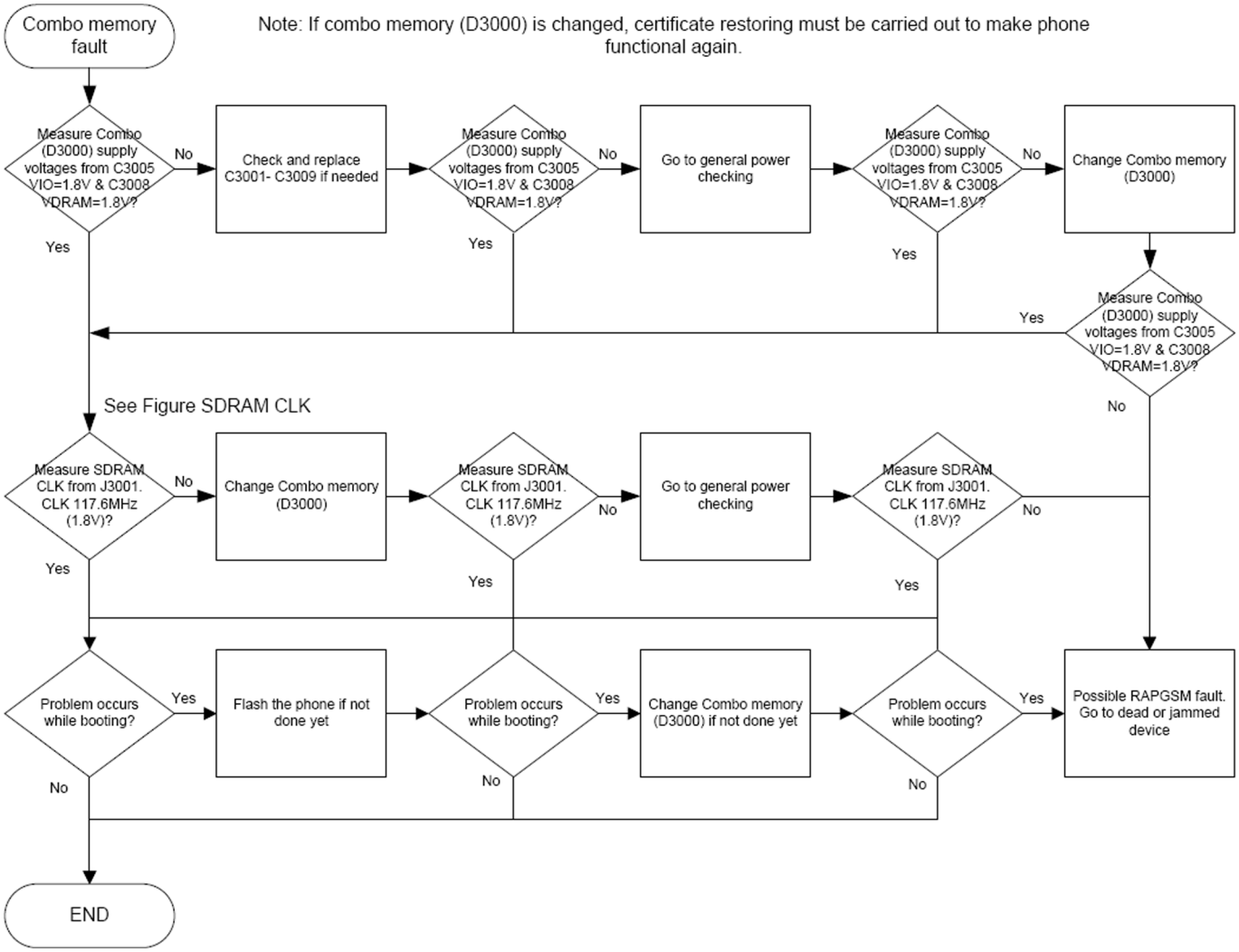
## COMBO memory troubleshooting

### Troubleshooting flow




## Keyboard troubleshooting

### Context

There are two possible failure modes in the keyboard: a) One or more keys can be stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, rust), b) Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcut or open connection).

For a more detailed description of the keyboard and keymatrix, see section Keyboard. If the failure mode is not clear, start with the Keyboard Test in Phoenix.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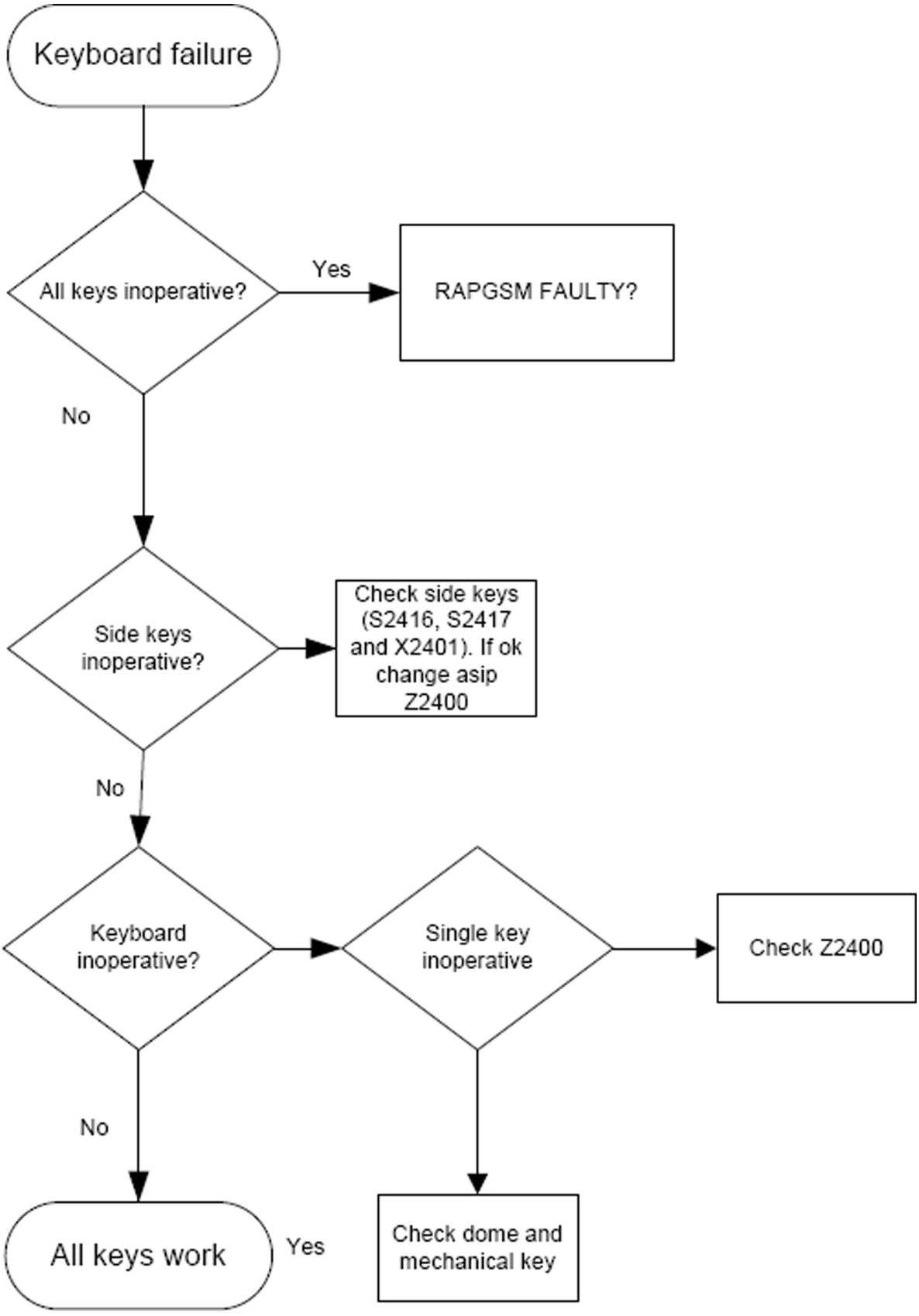
## Troubleshooting flow





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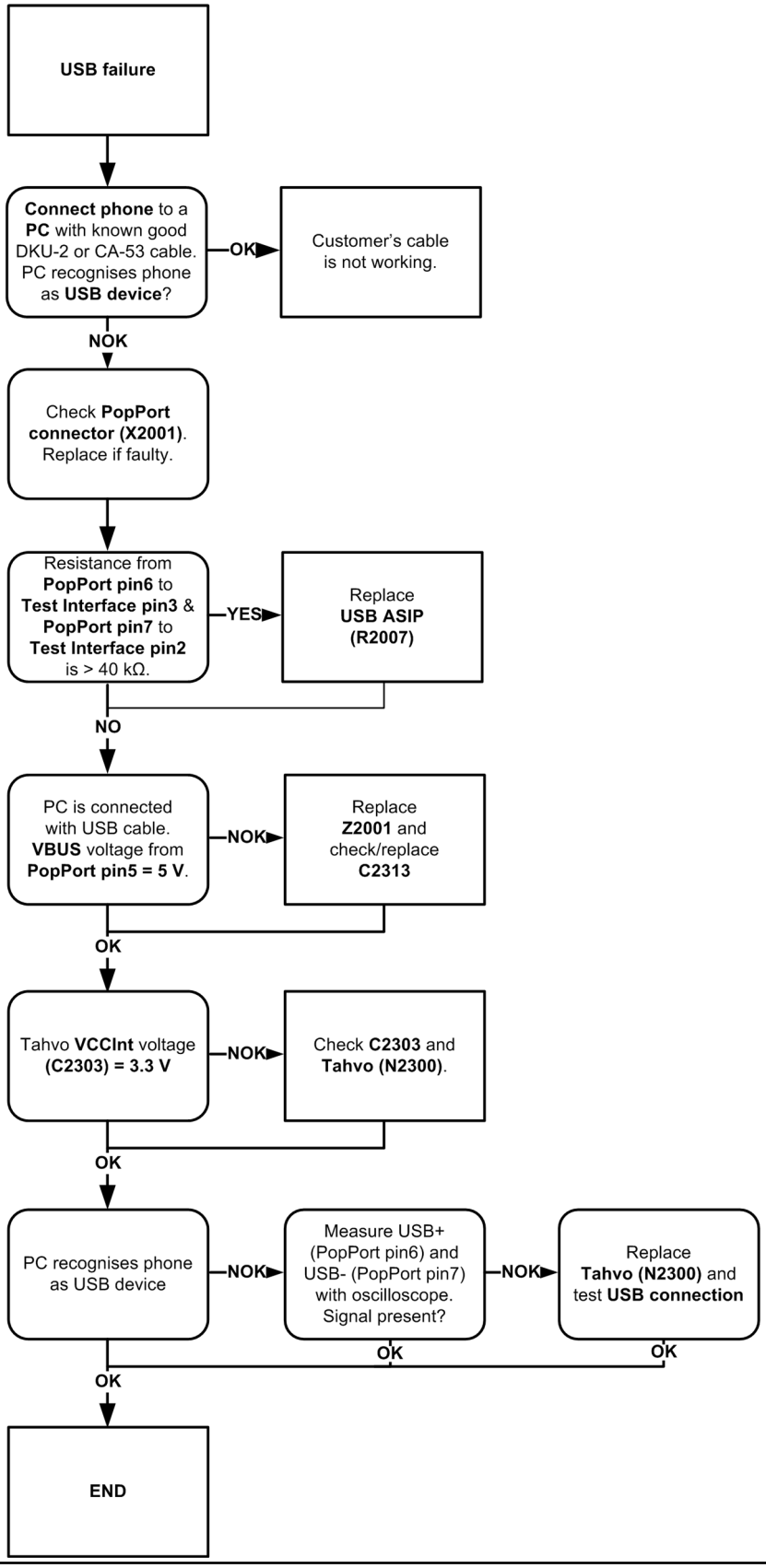
## USB troubleshooting

### Troubleshooting flow





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## Backup battery troubleshooting

Verify that the backup battery is empty (U<1V). Switch the phone on. Measure voltage of the battery when the main battery is connected to the phone and the phone is switched on.

Wait a few minutes and monitor that the backup battery voltage is rised. Switch off the phone and disconnect the main battery and monitor that voltage of backup battery is filled. Normal behaviour of the voltage is described pictures.

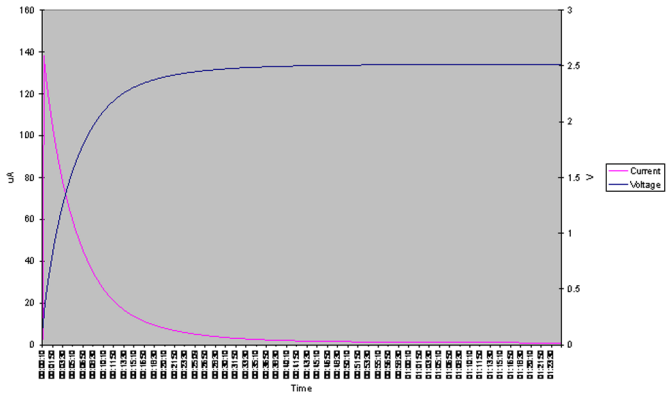


**Figure 40 Charging backup battery**

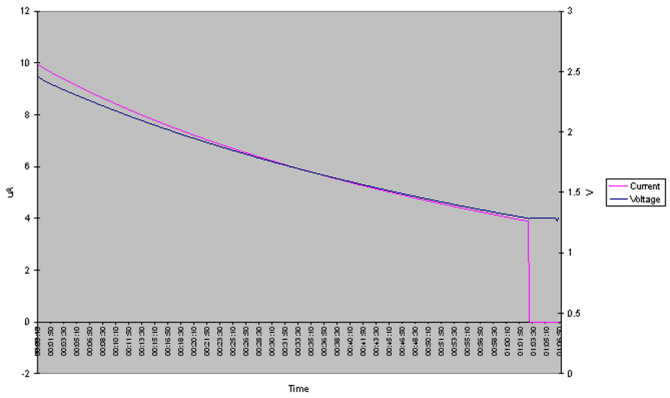


**Figure 41 Discharging backup battery**

If the voltage rises and falls quickly, battery is dead. If the voltage stays 0V, check resistance VBACK<-> GND: If there is no short circuit, Retu is faulty. Replace Retu.


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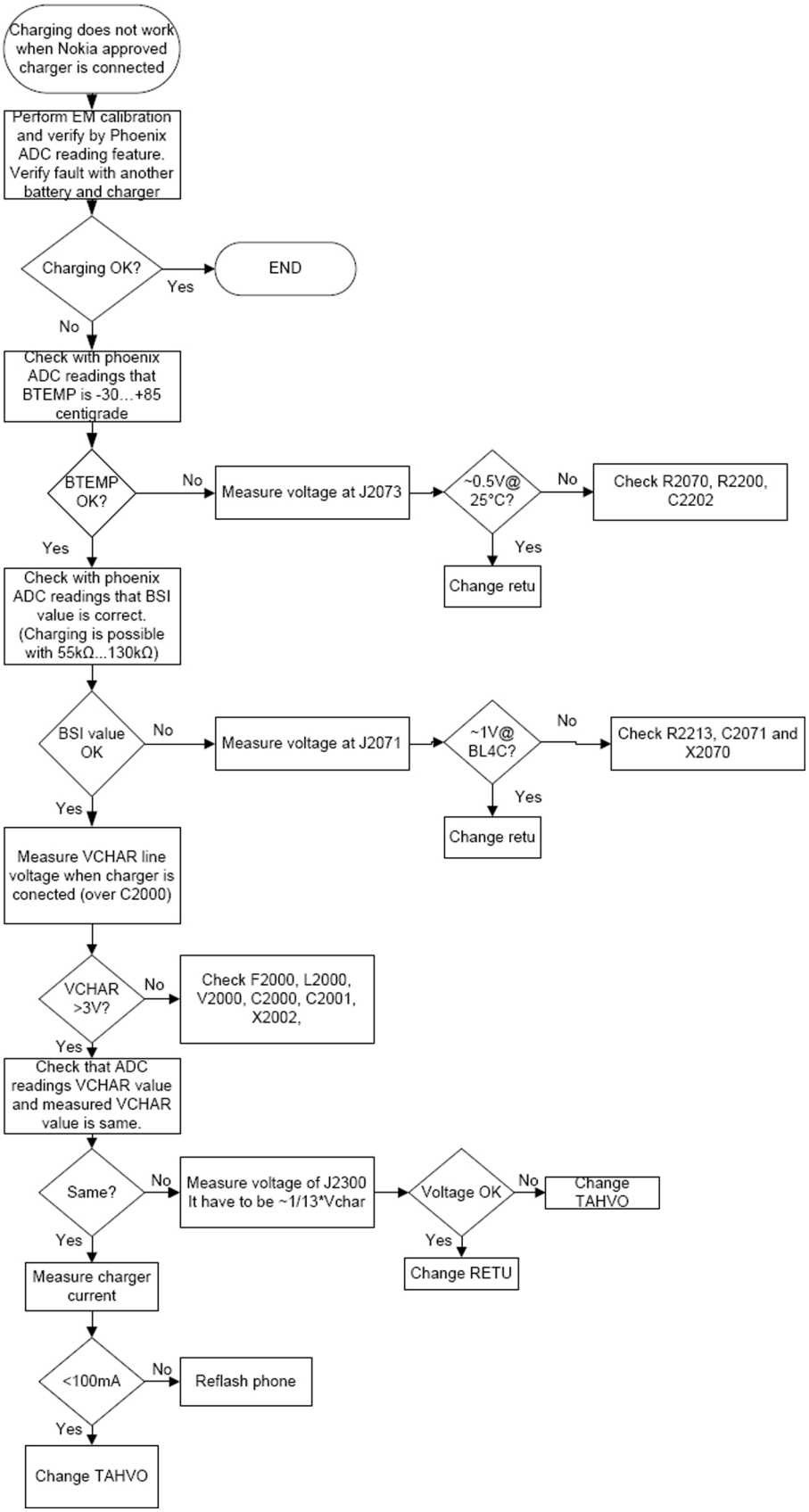
## Charging troubleshooting

### Troubleshooting flow





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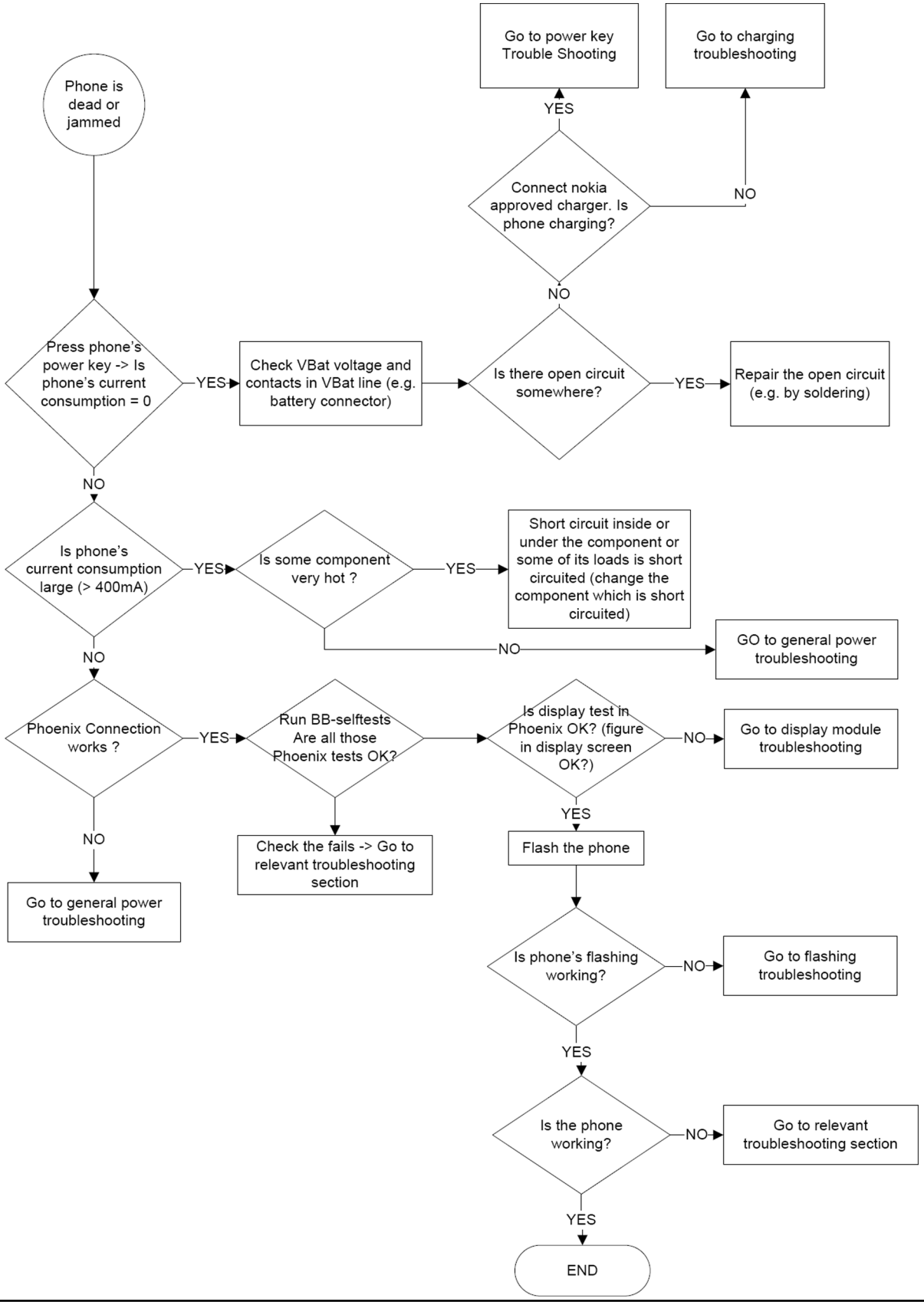
## Dead or jammed troubleshooting

### Troubleshooting flow





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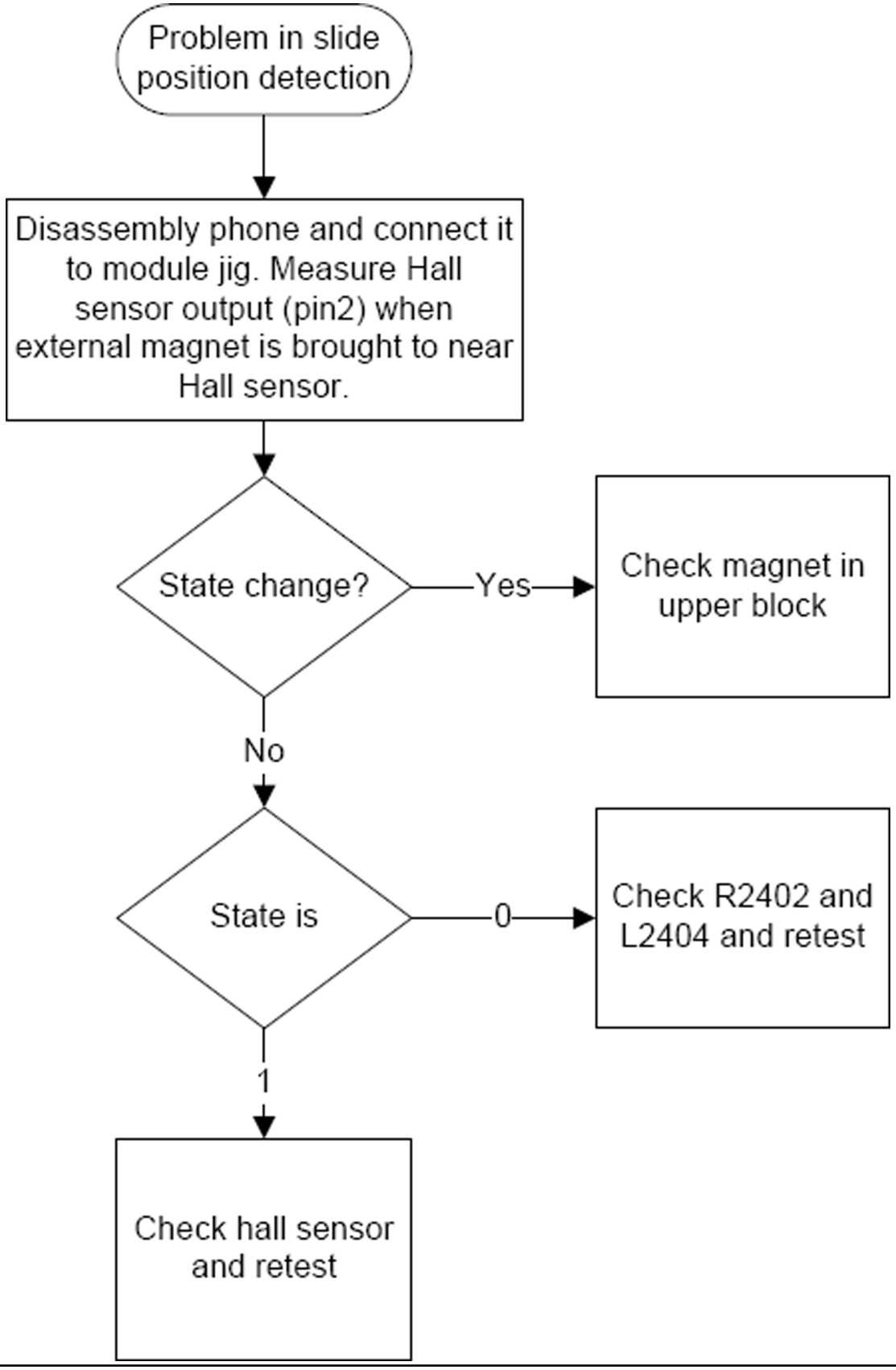
## Hall sensor troubleshooting

### Troubleshooting flow





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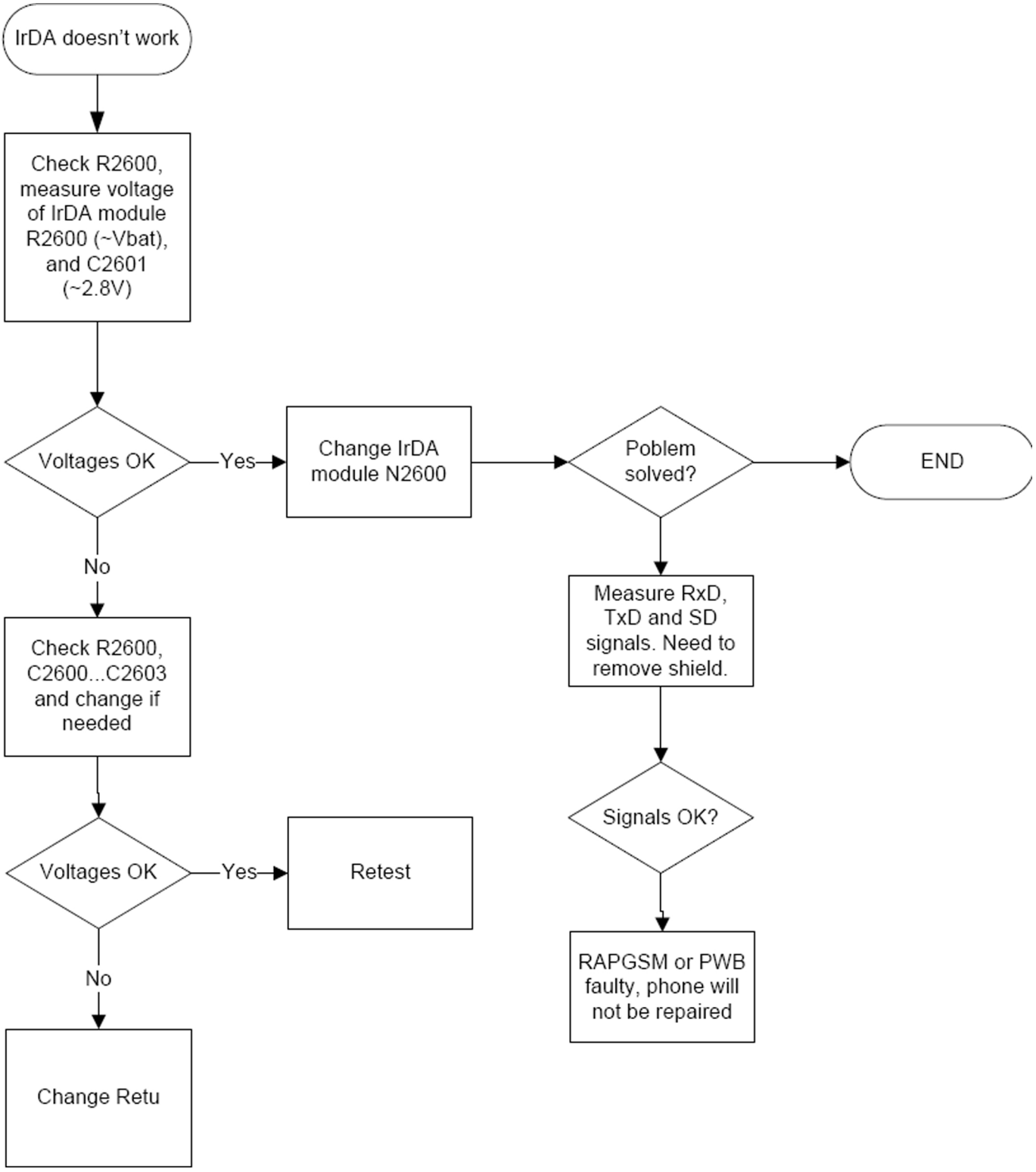
## Irda troubleshooting

### Troubleshooting flow





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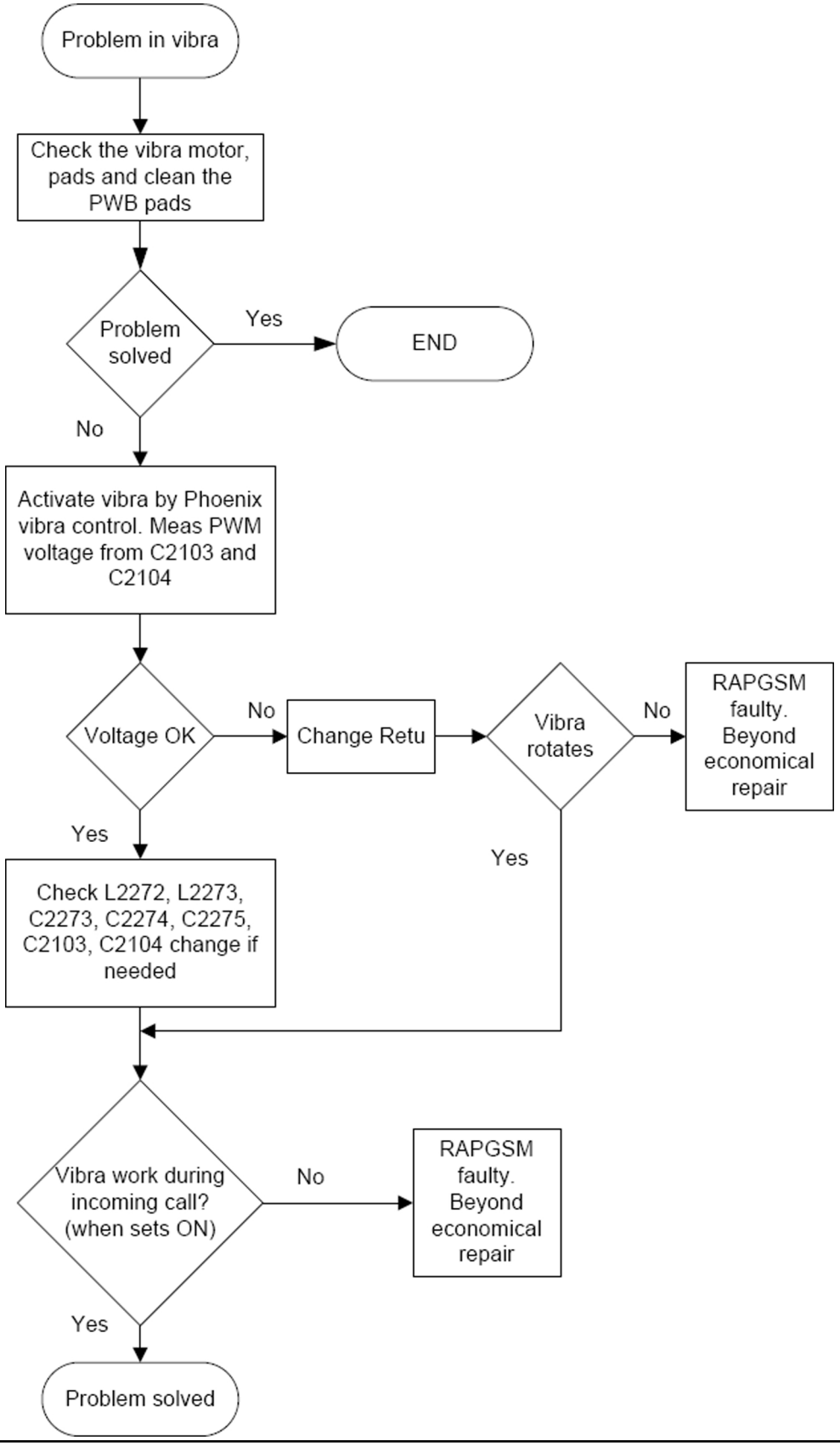
## Vibra troubleshooting

### Troubleshooting flow





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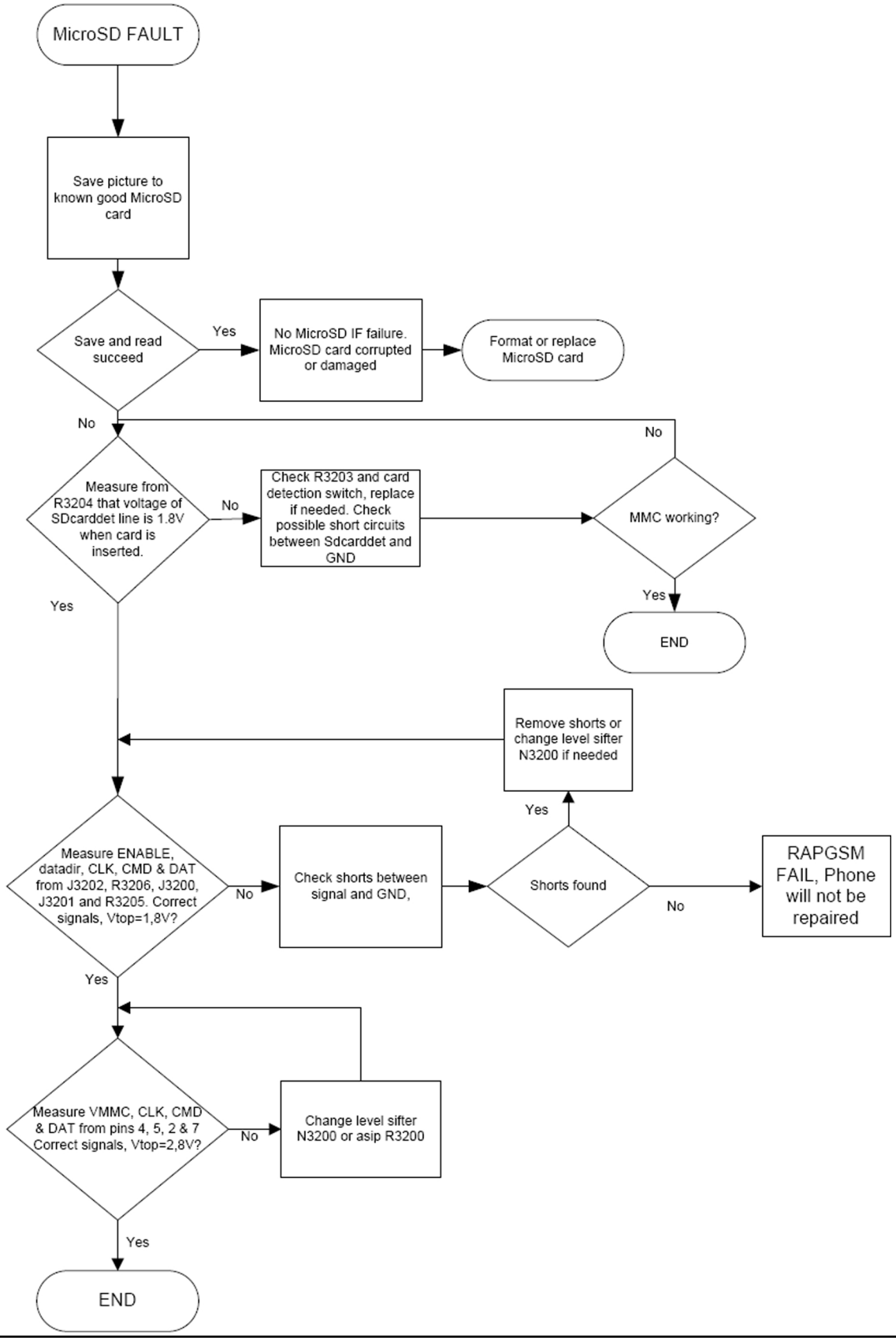
## MicroSD troubleshooting

### Troubleshooting flow





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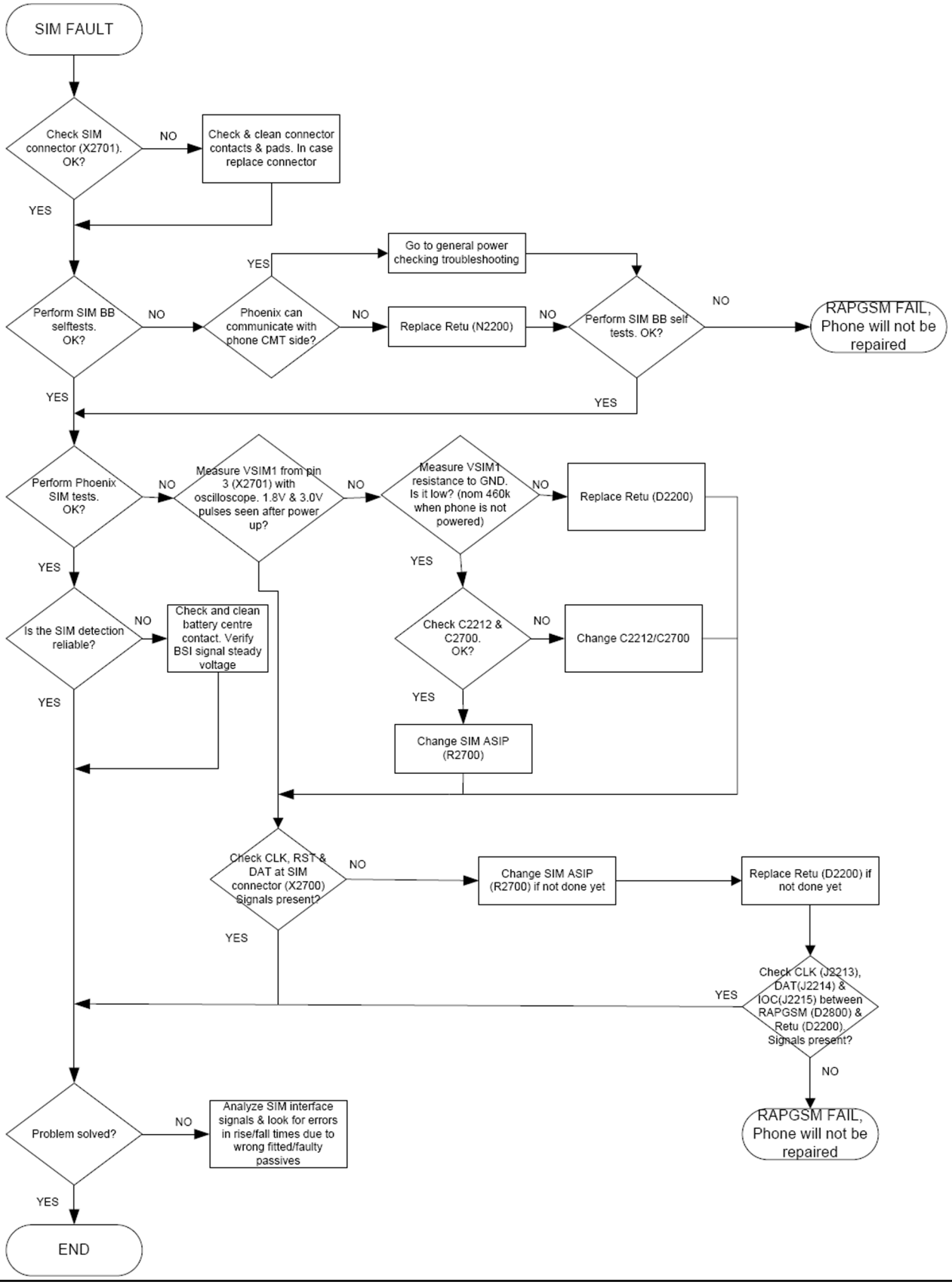
## SIM troubleshooting

### Troubleshooting flow





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# Display module troubleshooting

## General instructions for display troubleshooting

The first step is to verify with a working display that the fault is not on the display module itself. The display module cannot be repaired.

The second step is to check that the cellular engine is working normally. This can be done by connecting the phone to a docking station and starting Phoenix service software. With the help of Phoenix read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).

After these checks proceed to the display troubleshooting flowcharts. Use the Display Test tool in Phoenix to find the detailed fault mode.

## Operating modes of the display

The display is in a normal mode when the phone is in active use.

The display is in a partial idle mode when the phone is in the screen saver mode.

The operating modes of the display can be controlled with the help of Phoenix.

**Table 10 Display module troubleshooting cases**

| | |
|---|---|
| Display blank | There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases. |
| Image on the display not correct | Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram. |
| Backlight dim or not working at all | Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. Backlight is also controlled automatically by the ambient light sensor.<br>This means that in case the display is working (image OK), but the backlight is not, follow the Display and Keyboard Backlight troubleshooting. |
| Visual defects (pixel) | Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen.<br>The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table. |


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**Table 11 Pixel defects**

| Item | | White dot defect | | | | Black dot defect | Total |
|---|---|---|---|---|---|---|---|
| 1 | Defect counts | R | G | B | White Dot Total | 1 | 1 |
| | | 1 | 1 | 1 | 1 | | |
| 2 | Combined defect counts | Not allowed.<br>Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect. | | | | | |

**Note:** Blinking pixels are not allowed in normal operating temperatures and light conditions.


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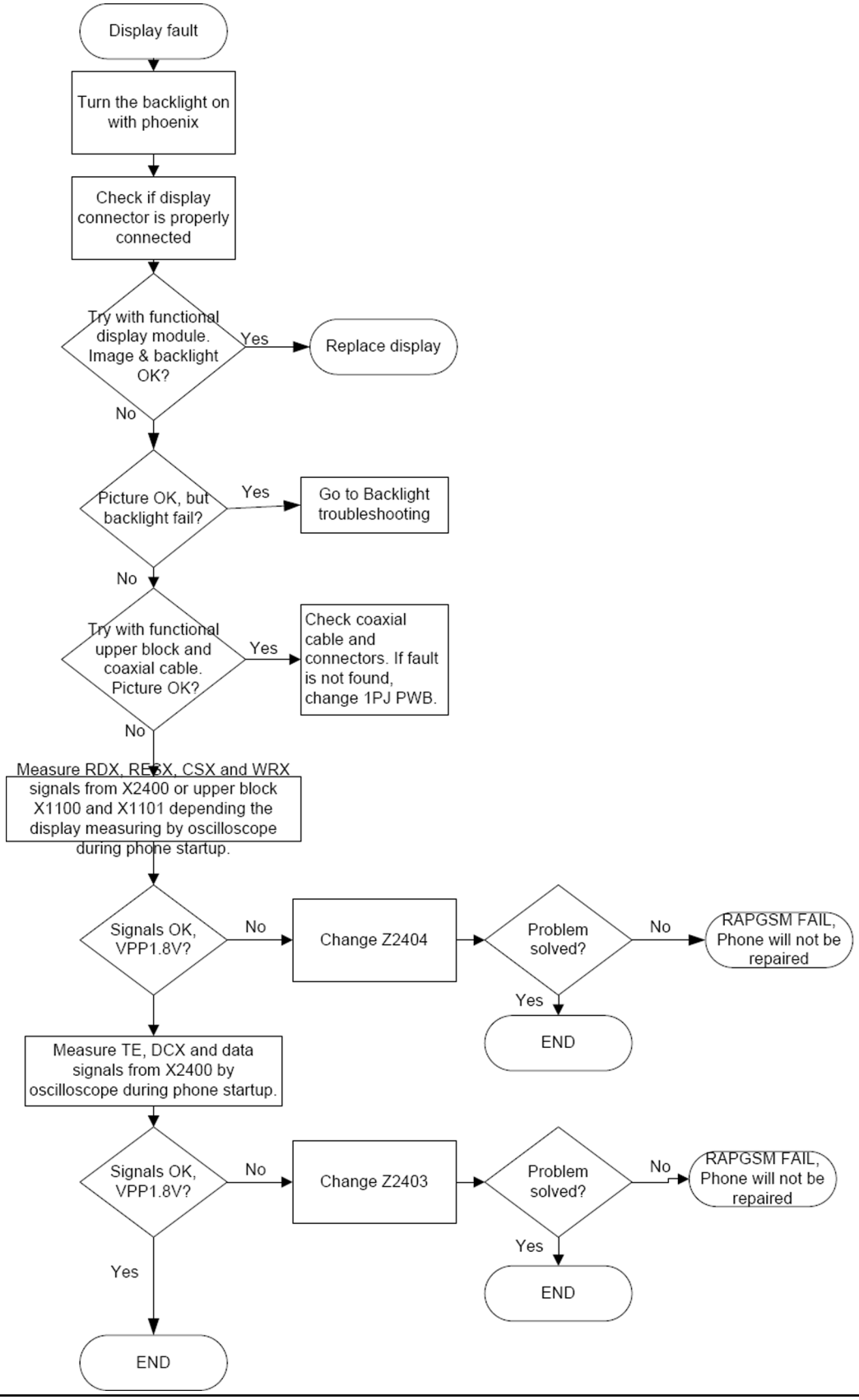
## Display fault troubleshooting (main and second displays)

### Troubleshooting flow





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## Displays and keyboard backlight troubleshooting

### Context

The device has two LED drivers that provide current for both displays and keyboard backlights. The both drivers get same PWM signal (from Tahvo). When the keyboard backlights are turned off, a switch is used to prevent PWM signal to go to the keyboard driver. There is also a switch for selecting which display is lighted on. It is not possible to turn on both displays' lights at the same time. The backlight brightness can be adjusted manually in Phoenix.


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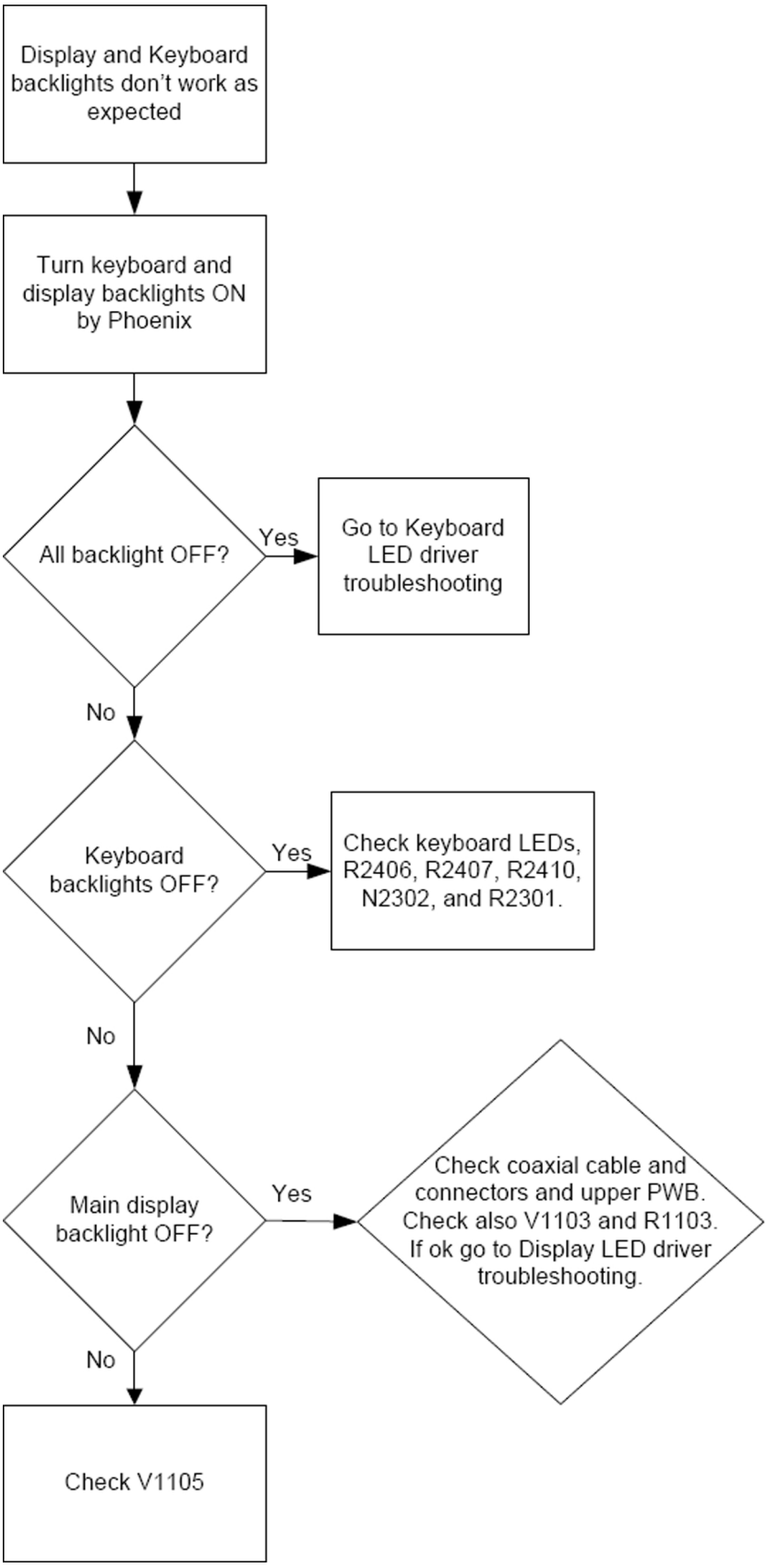
## Troubleshooting flow





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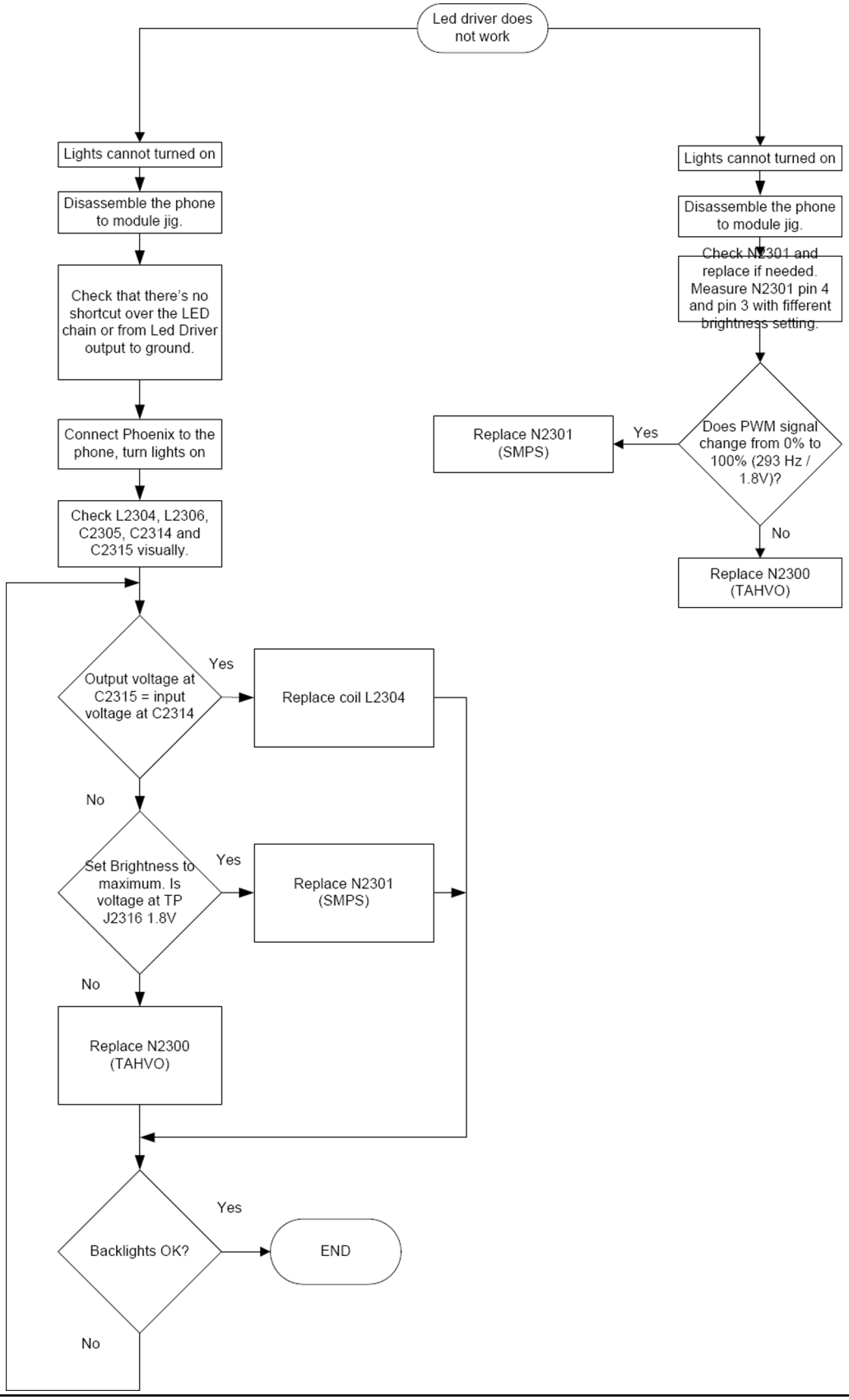
## Keyboard LED driver troubleshooting

### Troubleshooting flow





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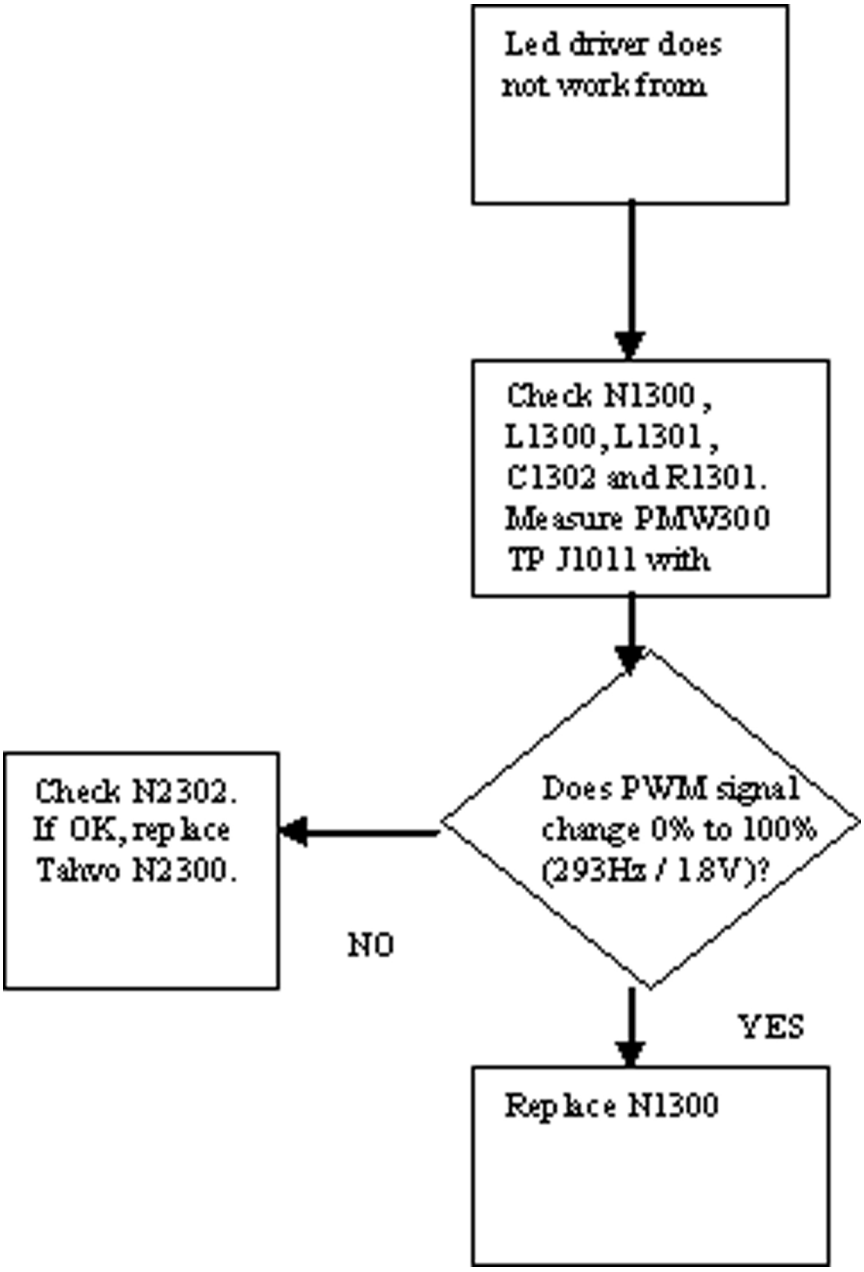
## Display LED driver troubleshooting

### Troubleshooting flow




## Camera troubleshooting

### Introduction to camera troubleshooting

Bad conditions often cause bad pictures. Therefore, the camera operation has to be checked in constant conditions or by using a second, known-to-be-good Nokia device as reference. Image quality is hard to measure quantitatively, and the difference between a good and a bad picture can be small. Some training or experience may be needed to detect what is actually wrong.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems are common: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- Dust (black spots)
- Lack of sharpness
- Bit errors

## Taking and evaluating test pictures

When *taking* a test picture, remember the following:

- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- If the phone is hot, let it rest for a while before taking the picture
- Make sure the optical system is clean
- Use highest possible resolution
- Make sure the light is suffiecient (bright office lightning)
- Do not take the picture towards light source
- Be as still as possible when taking the picture
- Distance should be at least 40cm, 1-2m is recommended

When *evaluating* a test picture, remember the following:

- The center of the picture is sharper than the edges
- The image may be blurred, though it does not show in the viewfinder
- Analyse the picture from your PC monitor, full colour setting is recommended
- If possible, compare with a picture of the same motive taken with a similar Nokia device


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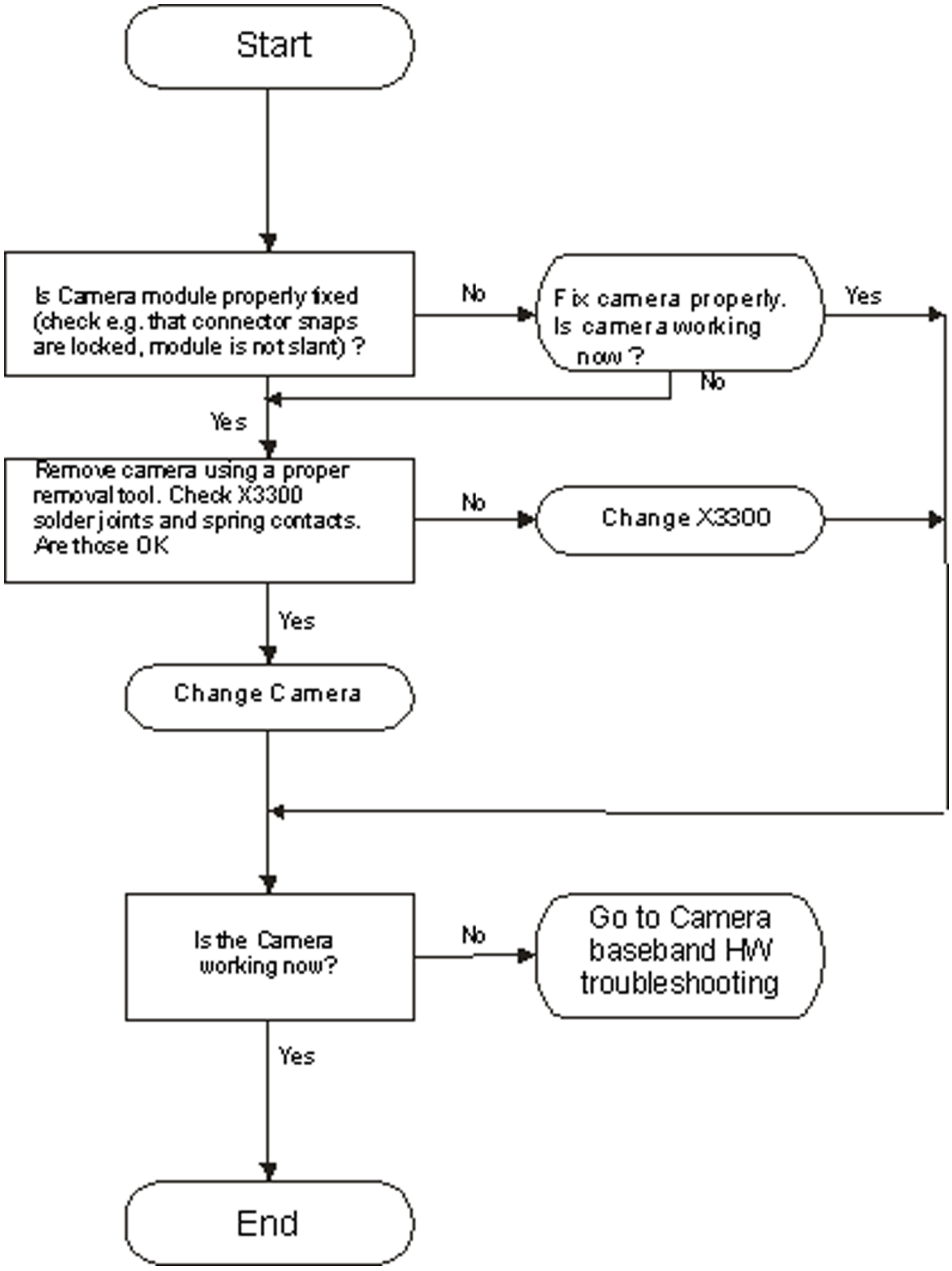
## Camera hardware failure message troubleshooting

### Troubleshooting flow





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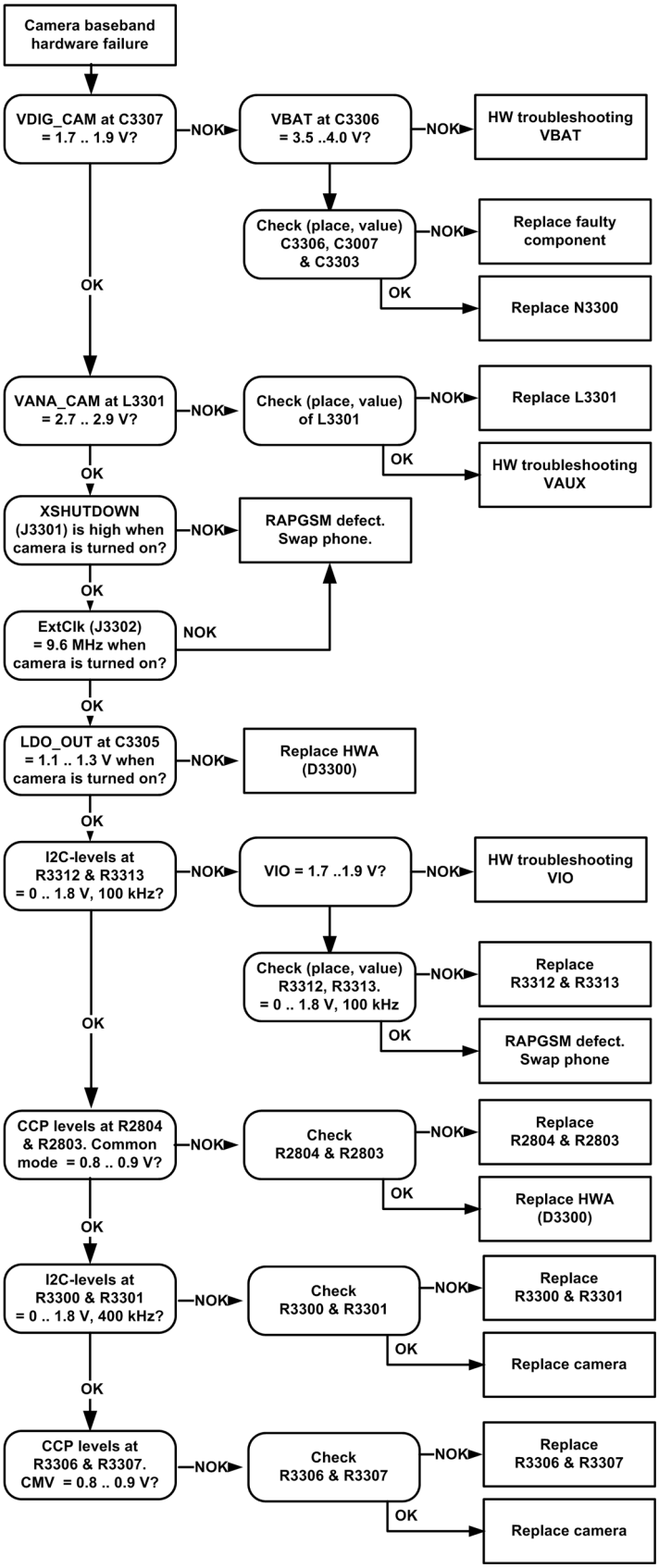
## Camera hardware troubleshooting

# Camera hardware troubleshooting





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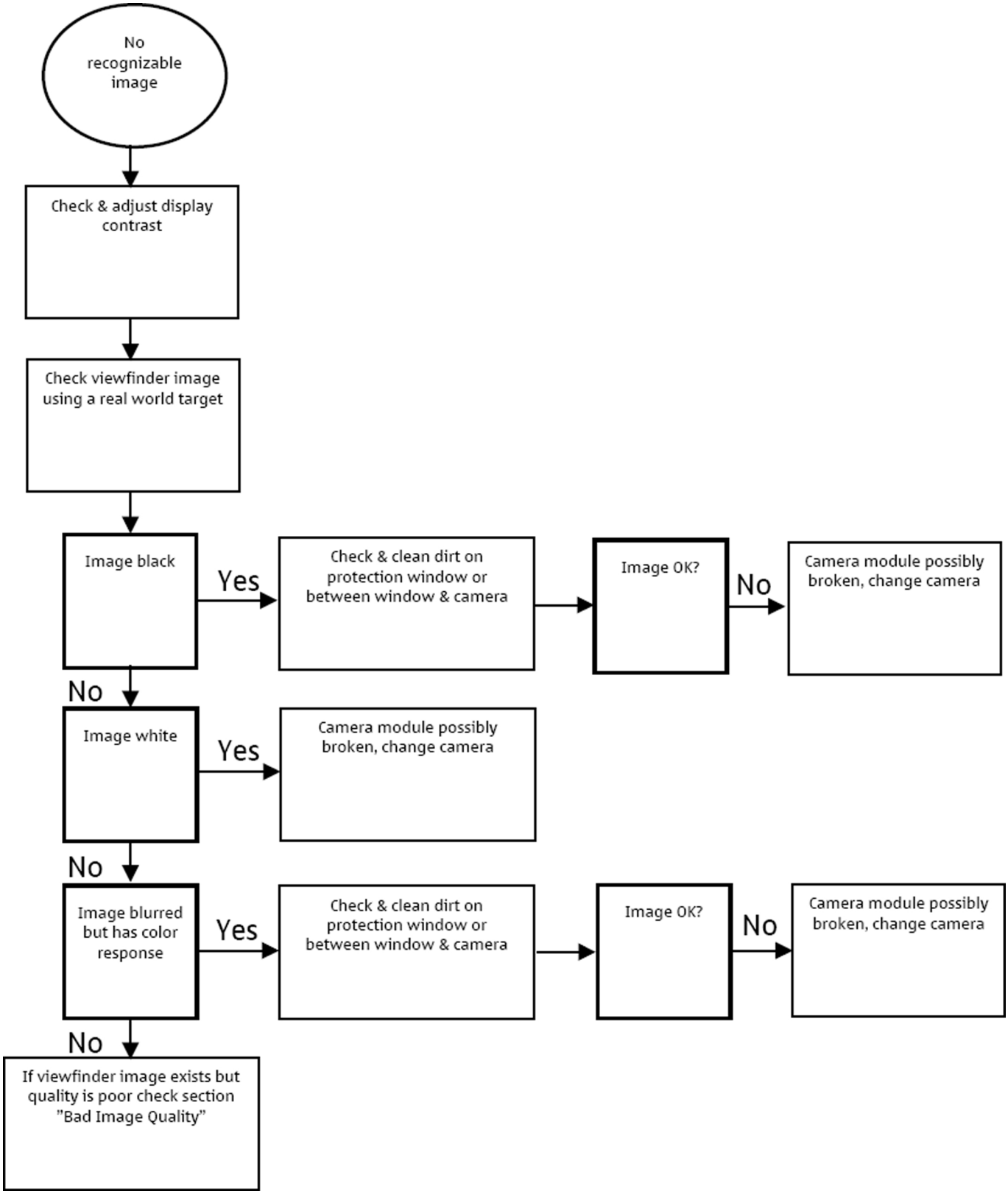
## Front camera viewfinder troubleshooting

### Troubleshooting flow





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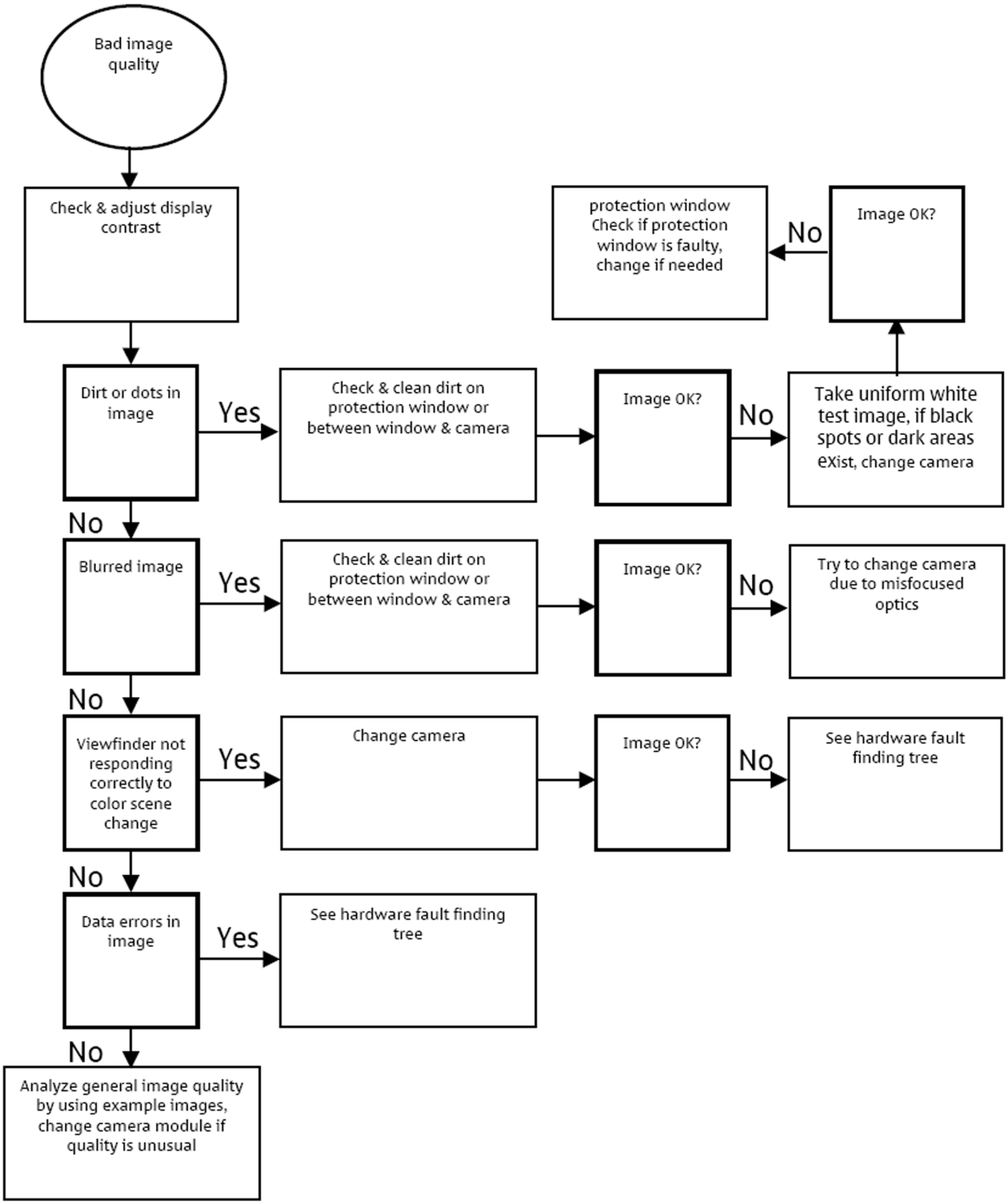
## Front camera bad image quality troubleshooting

### Troubleshooting flow





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## RM-178 Bluetooth troubleshooting

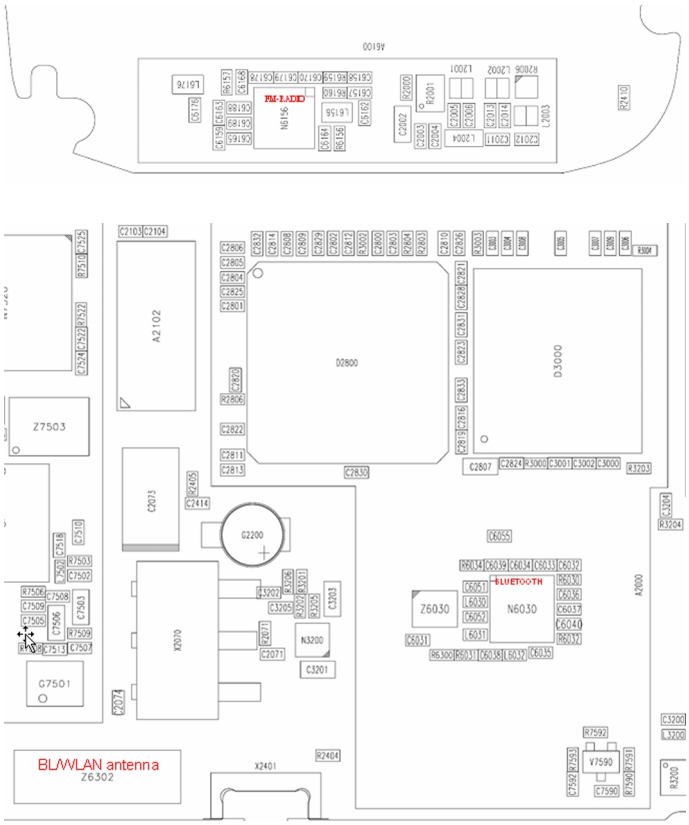
### Introduction to Bluetooth/FM Radio troubleshooting

There are two main Bluetooth problems that can occur:

| Problem | Description |
|---|---|
| Detachment of the BT antenna. | This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB. (see next page for details about BT antenna HW and Mechanics) |
| A malfunction in the BT ASIC, BB ASICs or Phone's BT SMD components. | This is unpredictable and could have many causes i.e. SW or HW related. |

The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component.

### Bluetooth/FM Radio component layout




### Bluetooth settings for Phoenix

#### Steps

1. Start *Phoenix* service software.
2. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.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3. Place the phone to a flash adapter in the local mode.
4. Choose **Testing→Bluetooth LOCALS** .
5. Locate JBT-9's serial number (12 digits) found in the type label on the back of JBT-9.
   In addition to JBT-9, also SB-6, JBT-3 and JBT-6 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.
   This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click **Run BER Test**.

## Results

Bit Error Rate test result is displayed in the *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window.

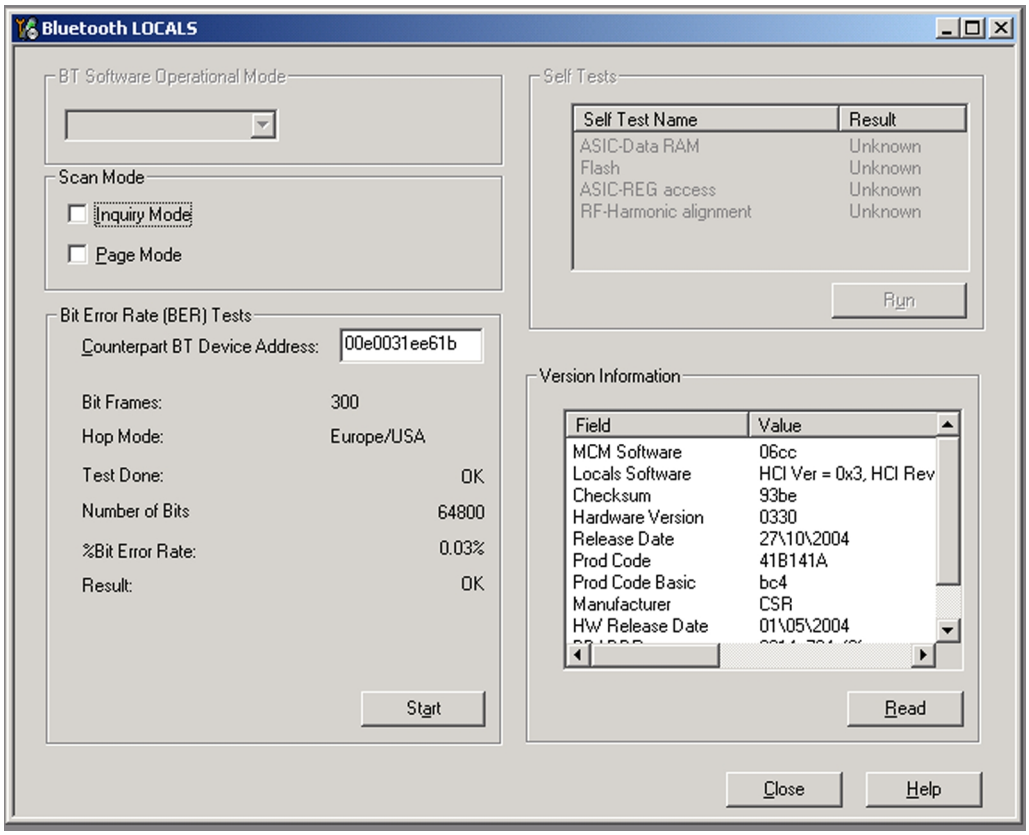


**Figure 42 BER test result**

## Bluetooth self tests in Phoenix

## Steps

1. Start *Phoenix* service software.
2. Choose**File→Scan Product.**
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing→Self Tests.**
6. In the *Self Tests* window check the following Bluetooth related tests:
   - **ST_LPRF_IF_TEST**


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- **ST_LPRF_AUDIO_LINES_TEST**
- **ST_BT_WAKEUP_TEST**

7. To run the tests, click **Start**.

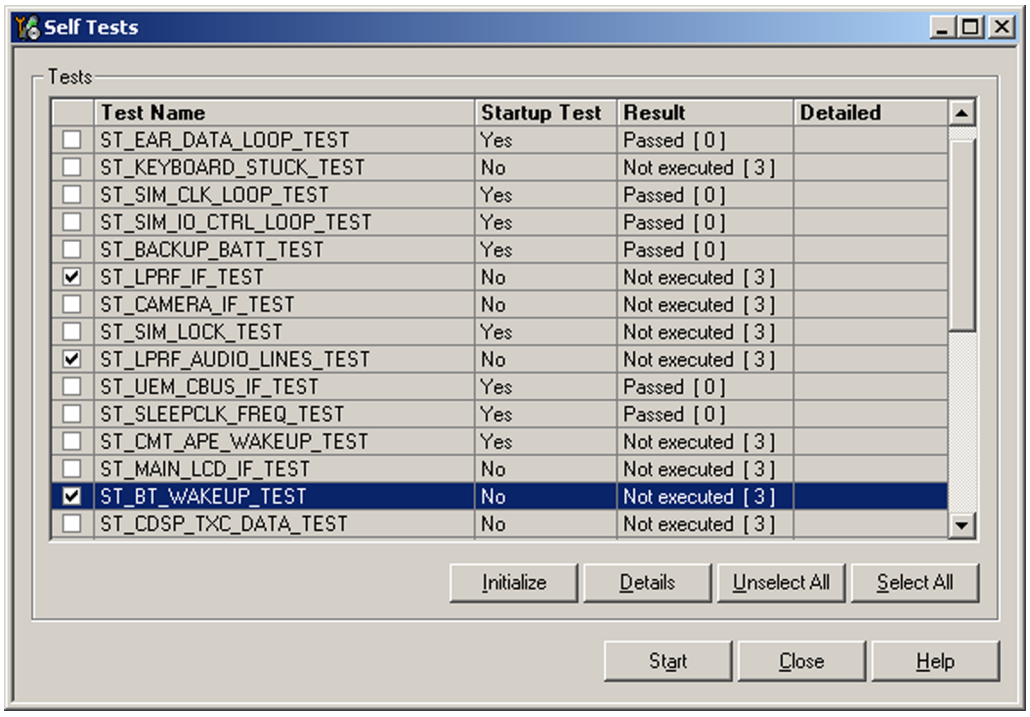


**Figure 43 Bluetooth self tests in *Phoenix***


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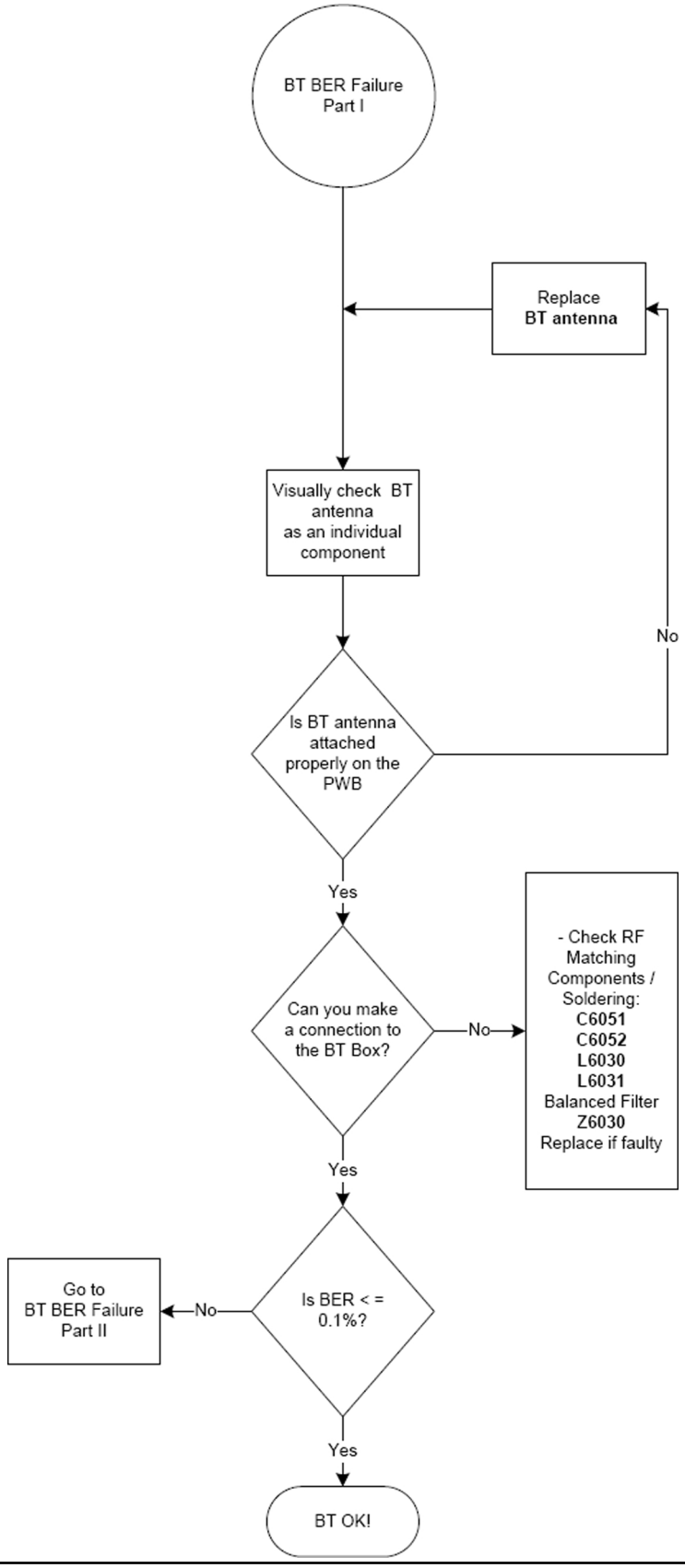
## Bluetooth BER failure troubleshooting

### Troubleshooting flow





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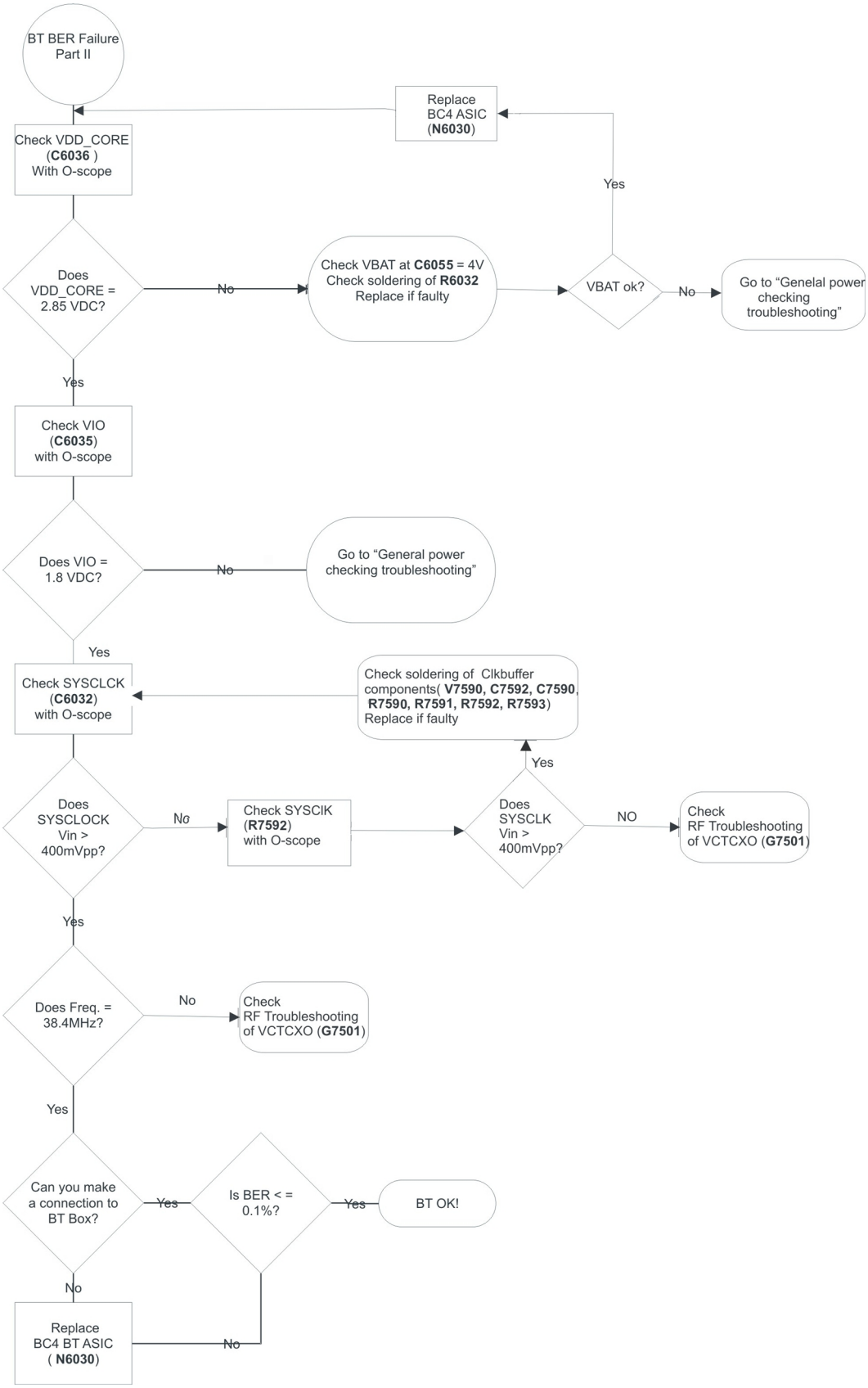



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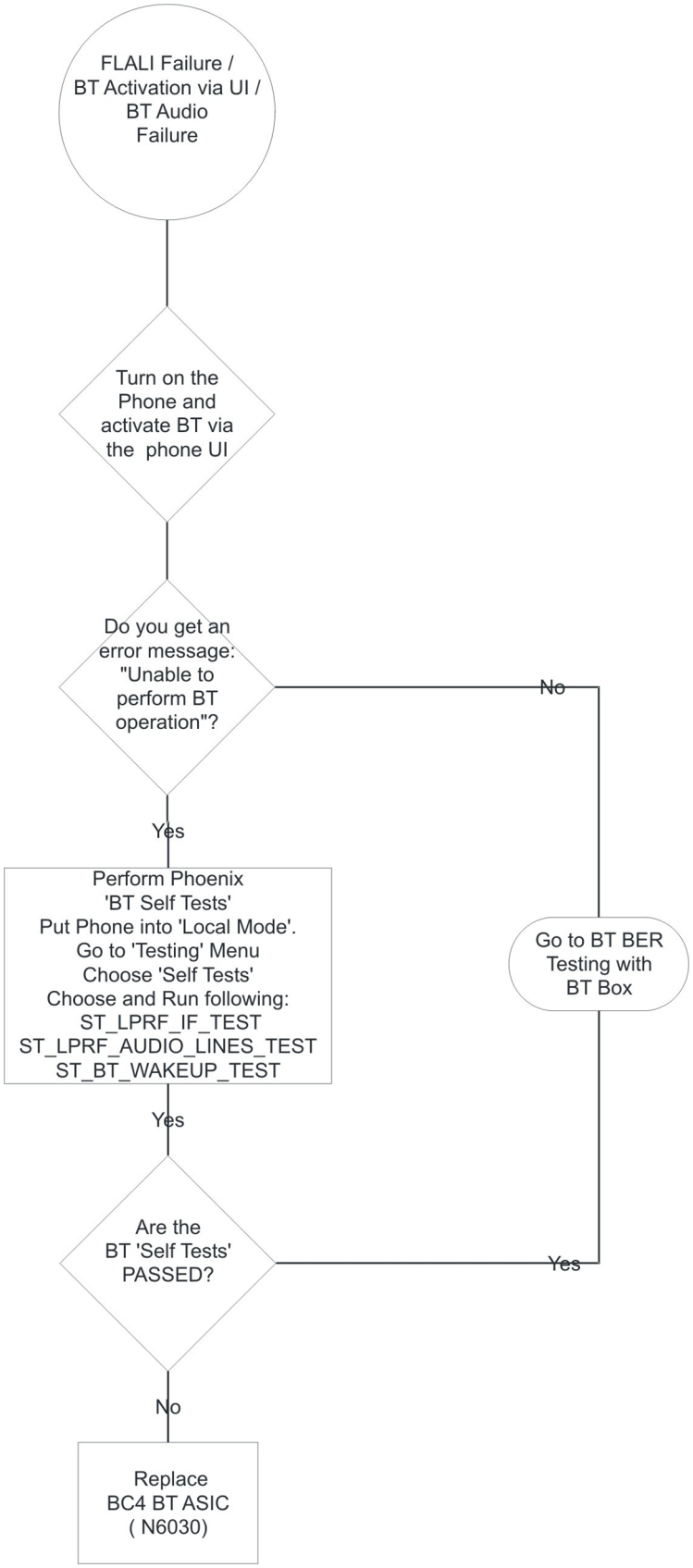
## BT audio failure troubleshooting

### Troubleshooting flow





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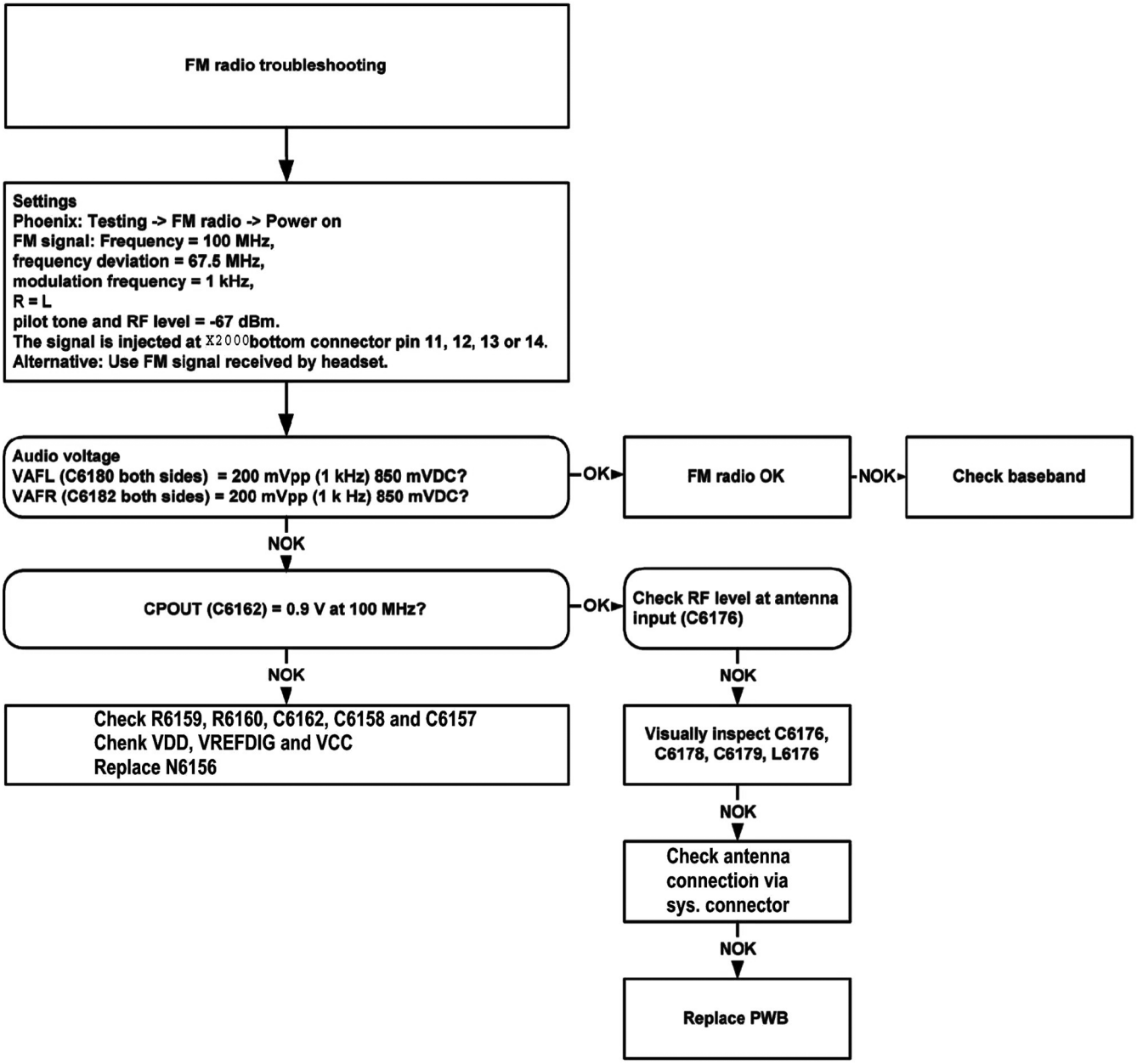
## FM Radio troubleshooting

### Troubleshooting flow




## Audio troubleshooting

### Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.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The input signal for each loop test can be either single-ended or differential.

## Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V

## Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

## Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

| Loop test | Input terminal | Output terminal | Path gain [dB] (fixed) | Input voltage [mVp-p] | Differential output voltage [mVp-p] | Output DC level [V] | Output current [mA] |
|---|---|---|---|---|---|---|---|
| External Mic to External Earpiece | XMICP and GND | HSEAR R P, HSEAR R N and GND | -2.9 | 1000 | 720 | 1.2 | NA |
| | | HSEAR P, HSEAR N and GND | | | | | |
| | XMICN and GND | HSEAR R P, HSEAR R N and GND | | | | | |
| | | HSEAR P, HSEAR N and GND | | | | | |


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| Loop test | Input terminal | Output terminal | Path gain [dB] (fixed) | Input voltage [mVp-p] | Differential output voltage [mVp-p] | Output DC level [V] | Output current [mA] |
|---|---|---|---|---|---|---|---|
| External Mic to Internal Earpiece | XMICP and GND | EarP and GND | -4.5 | 1000 | 600 | 1.2 | NA |
| | | EarN and GND | | | | | |
| | XMICN and GND | EarP and GND | | | | | |
| | | EarN and GND | | | | | |
| External Mic to Internal handsfree | XMICP and GND | B2102 pads | -5 | 1000 | 560 | 0 | 25mA (calc.) |
| | XMICN and GND | B2102 pads | | | | | |
| Internal Mic to External Earpiece | B2100 (OUT/ GND) | HSEAR R P, HSEAR R N and GND | 22.7 | 100 | 1360 | 1.2 | NA |
| | | HSEAR P, HSEAR N and GND | | | | | |
| | | HSEAR R P, HSEAR R N and GND | | | | | |
| | | HSEAR P, HSEAR N and GND | | | | | |

## Measurement data

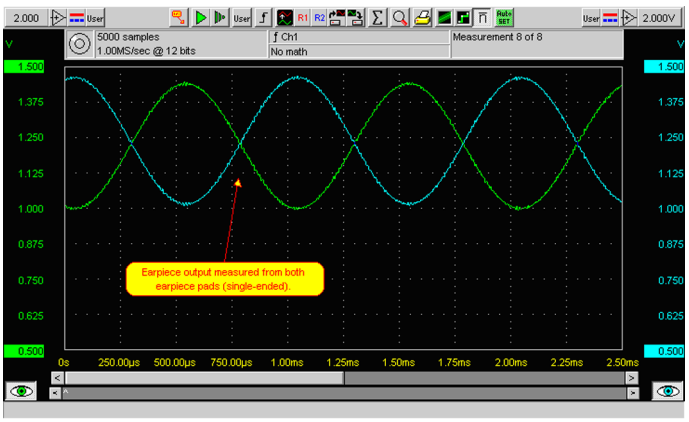


**Figure 44 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.**


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**Figure 45 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.**

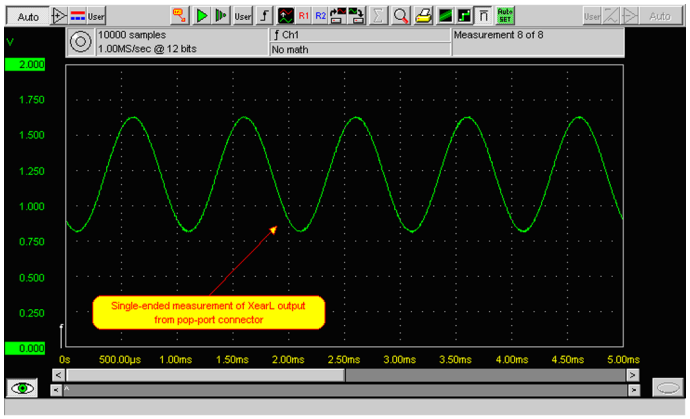


**Figure 46 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.**


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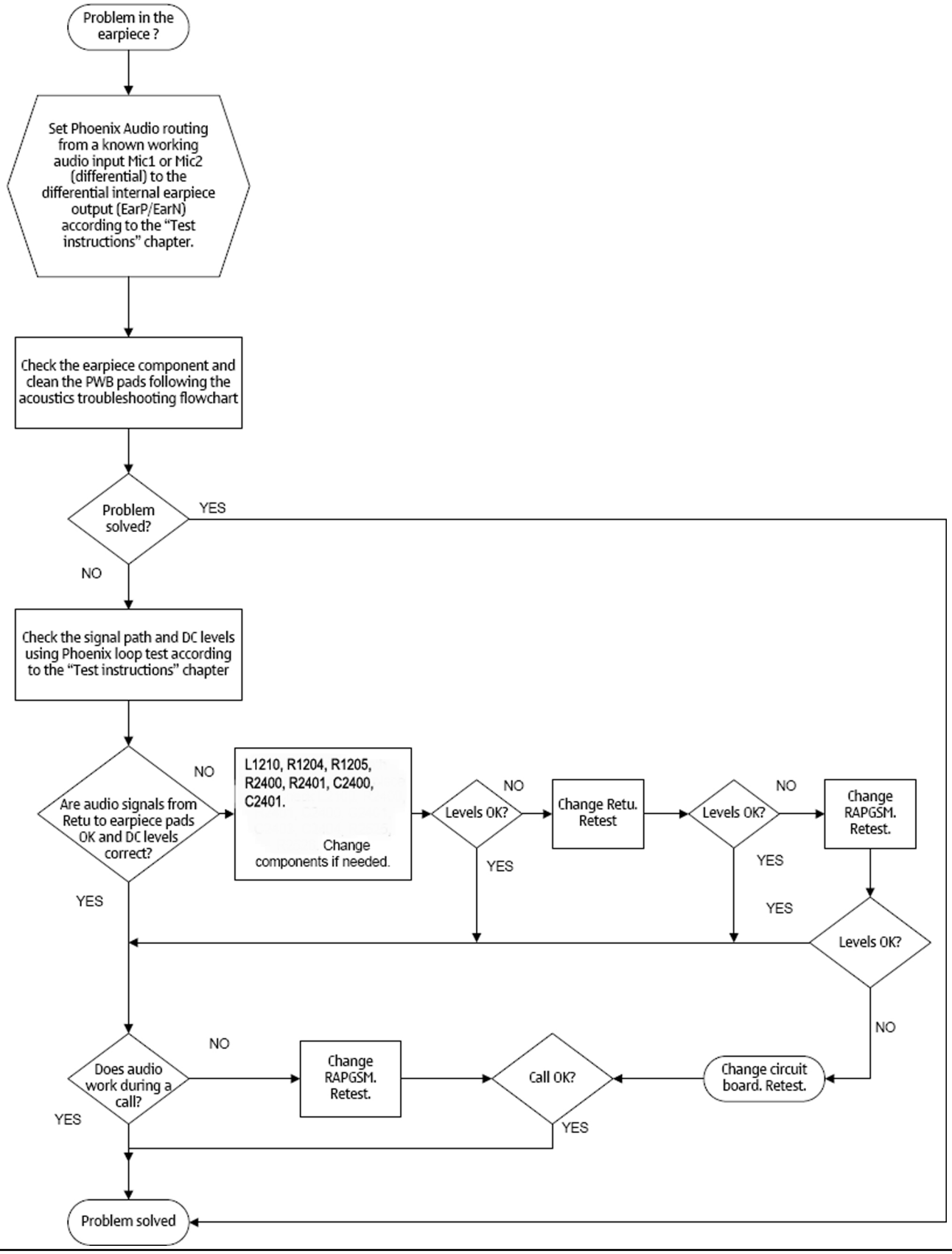
## Internal earpiece troubleshooting

### Troubleshooting flow





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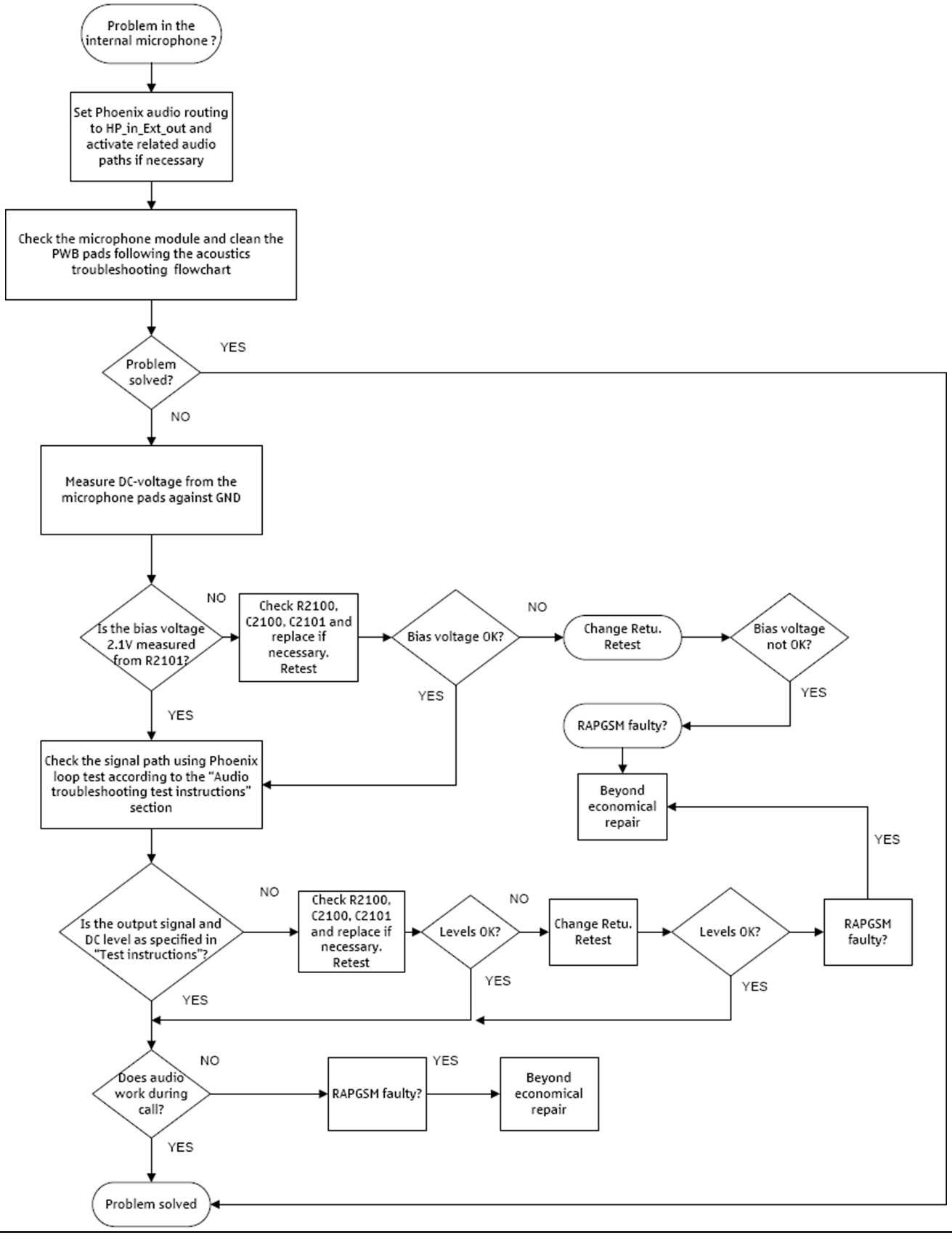
## Internal microphone troubleshooting

### Troubleshooting flow





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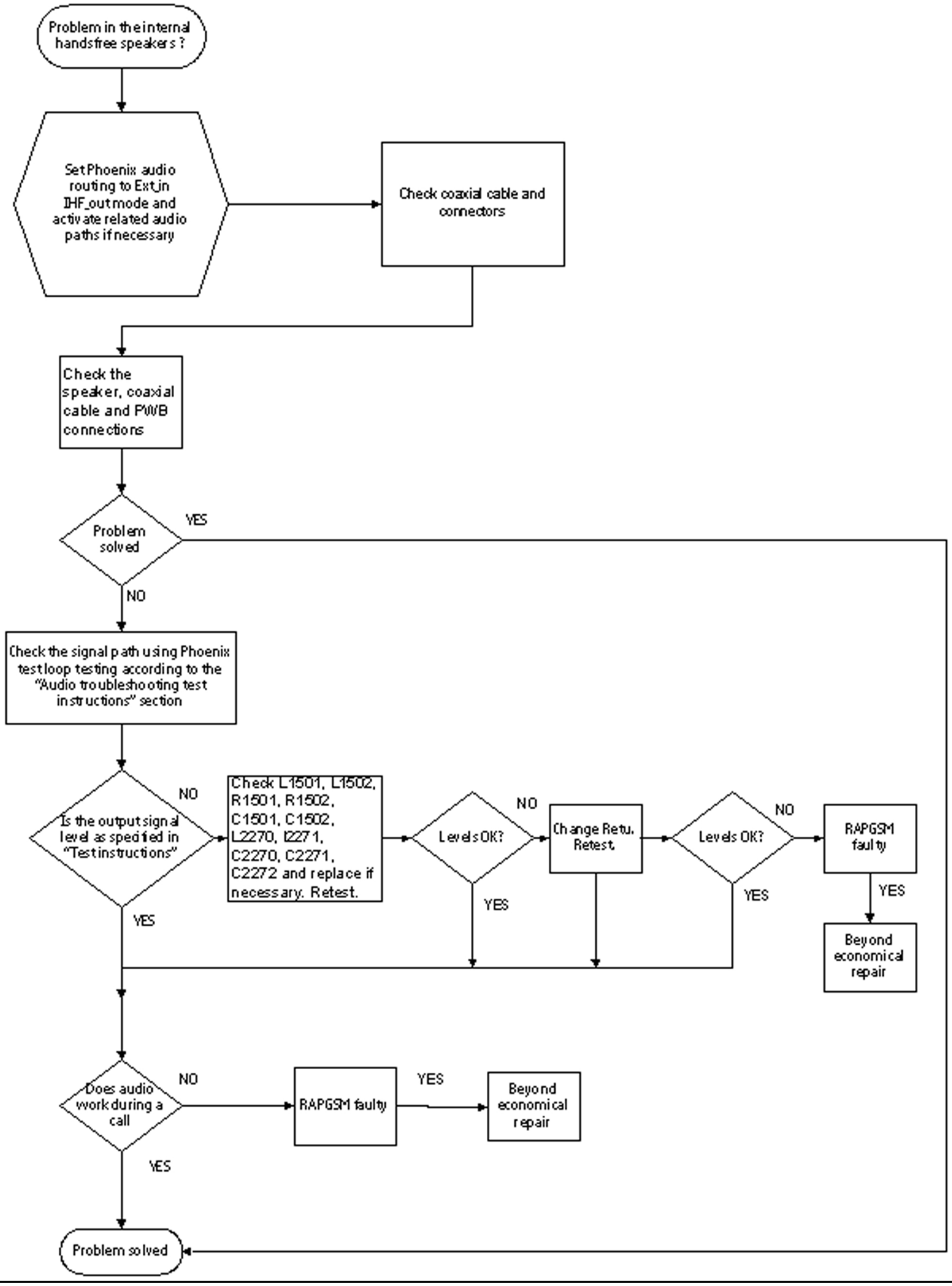
## IHF troubleshooting

### Troubleshooting flow





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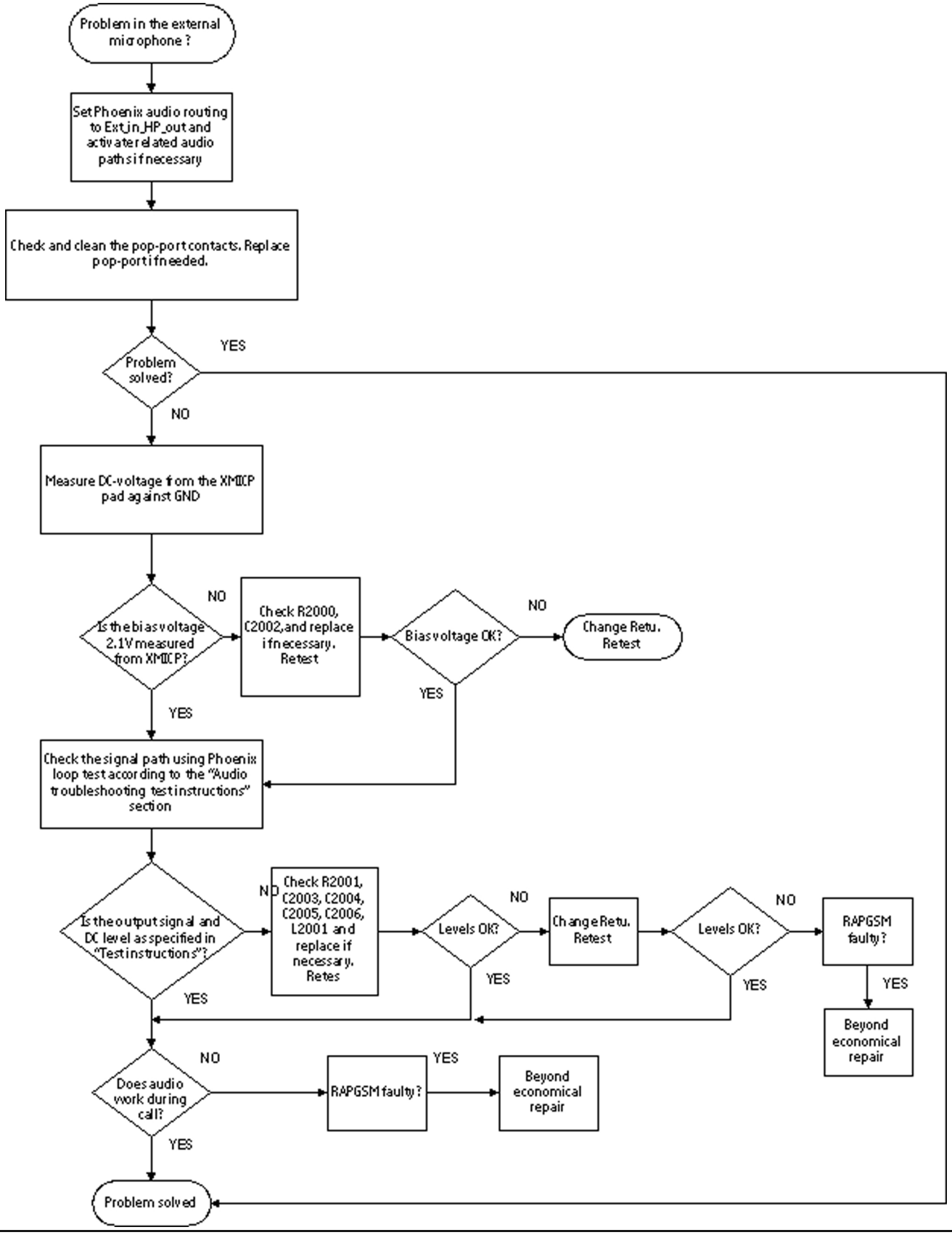
## External microphone troubleshooting

### Troubleshooting flow





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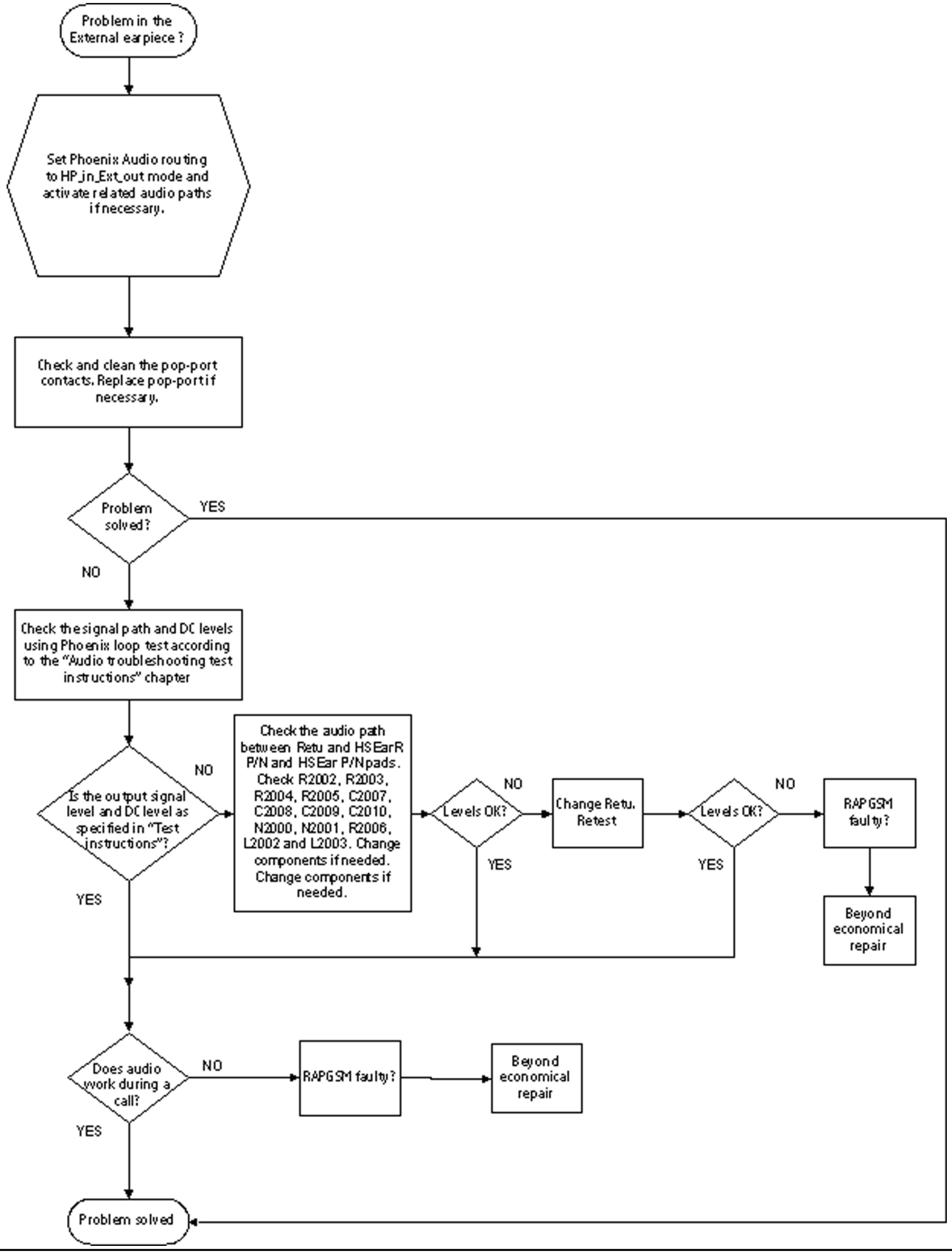
## External earpiece troubleshooting

### Troubleshooting flow





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## Introduction to acoustics troubleshooting

### Acoustics troubleshooting

Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by speaker(s). The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece radiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speakers radiates through a single hole on the back cover (B-cover). Microphone is located at the bottom, next to the system connector.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.


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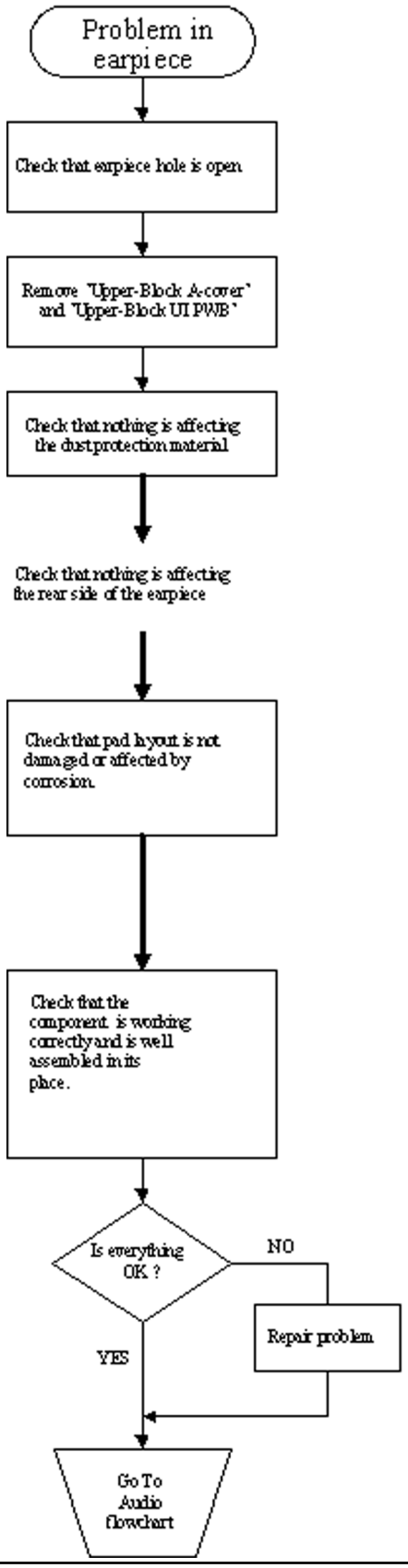
## Earpiece troubleshooting

### Troubleshooting flow





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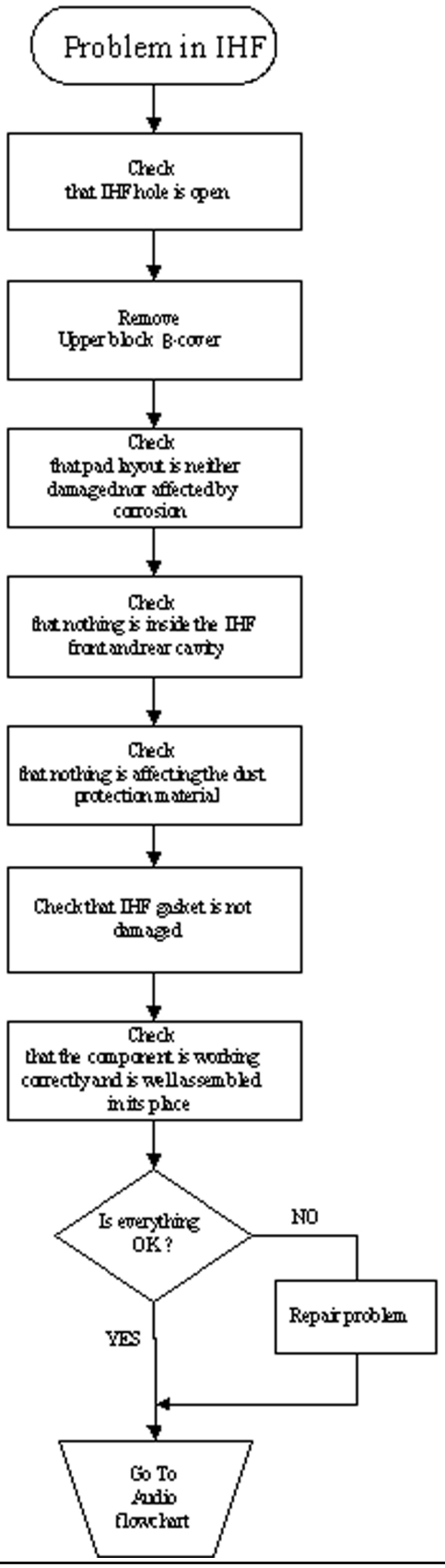
## IHF troubleshooting

### Troubleshooting flow





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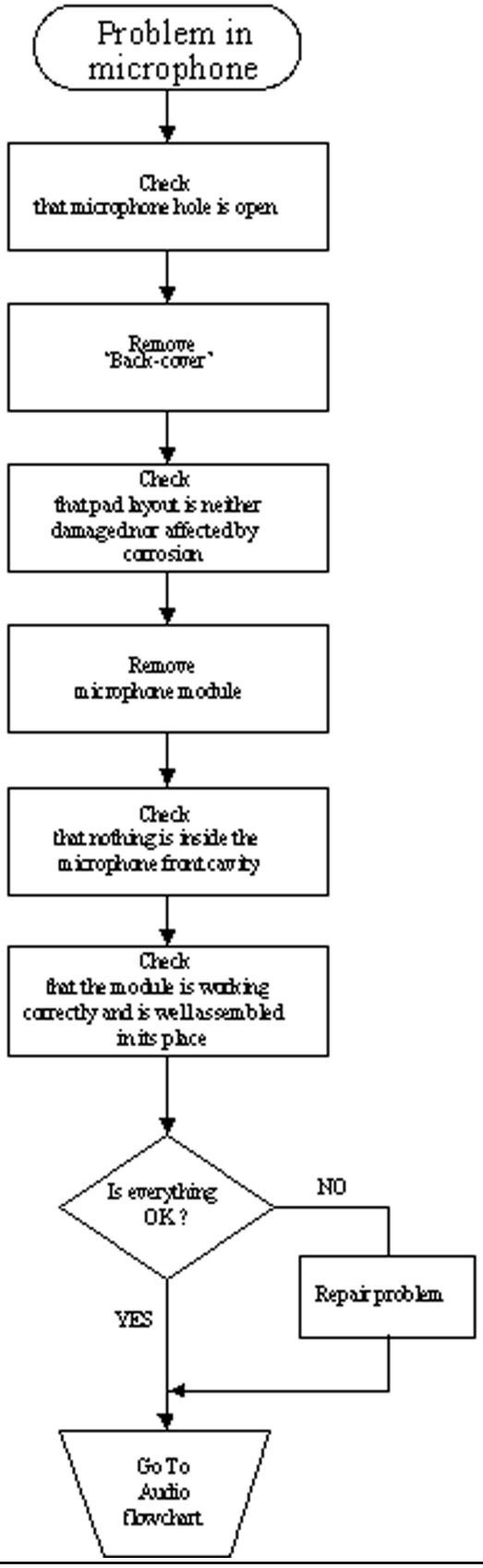
## Microphone troubleshooting

### Troubleshooting flow





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# Baseband manual tuning guide

## Energy management calibration

### Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

### Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File→ Scan Product.**
4. Choose **Tuning→Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   **Note:** ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

**Table 12 Calibration value limits**

| Parameter | Min. | Max. |
|---|---|---|
| ADC Offset | -20 | 20 |
| ADC Gain | 12000 | 14000 |
| BSI Gain | 1100 | 1300 |
| VBAT Offset | 2400 | 2650 |
| VBAT Gain | 19000 | 23000 |
| IBAT (ICal) Gain | 6200 | 15600 |

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.


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# 7 — RF Troubleshooting and Manual Tuning Guide


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## Introduction to RF troubleshooting

All measurements should be done using:

- spectrum analyser with a high-frequency high-impedance passive probe (LO-/reference frequencies and RF power levels)
- oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

> **Caution:** Also all measurements with an RF coupler should be performed in RF shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, it should be checked that there are no transmissions on the same frequencies as used in the tests.

The RF section of the phone is build around one RF ASIC: ASIC N7505.

> **Note:** Before changing N7505, please check the following things: supply voltages and serial communication coming from baseband toN7505 are OK. Please note that the grounding of the Frond End Module (FEM) is directly below FEM so it is difficult to check or change.

Most RF semiconductors are static discharge sensitive! ESD protection must be taken care of during repair (ground straps and ESD soldering irons). N7505 and FEM are moisture sensitive, so parts must be pre-baked prior to soldering.

In addition to key components, there are lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done mainly by checking if the soldering of the component is done properly.

Capacitor can be checked for shorts and resistors for value by means of an ohmmeter, but be aware in-circuit measurements should be evaluated carefully as other components connected to the same node can change the seen resistance.

Keep in mind that all measured voltages or RF levels depicted in the service manual are rough figures. Especially RF levels vary because of different measuring equipment or different grounding of the probe used.

When using an RF probe, use a pair of metallic tweezers to connect the probe ground to the PWB ground as close to the measurement point as possible. If measurements are performed in a product specific module jig, then “GND” pads should be used for the probe ground.

## RF key component placement

The RF section of the phone is build around one RF ASIC: ASIC N7505.


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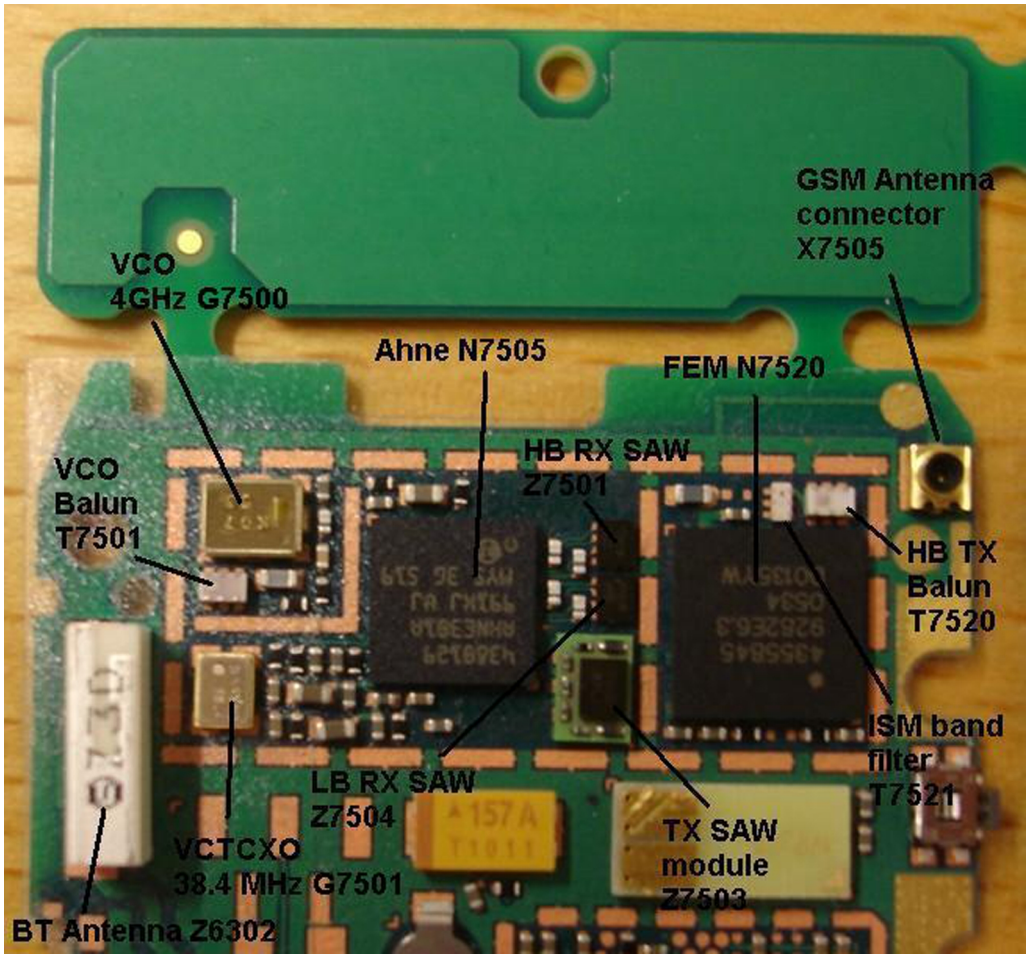


**Figure 47 RM-178 RF component placement**


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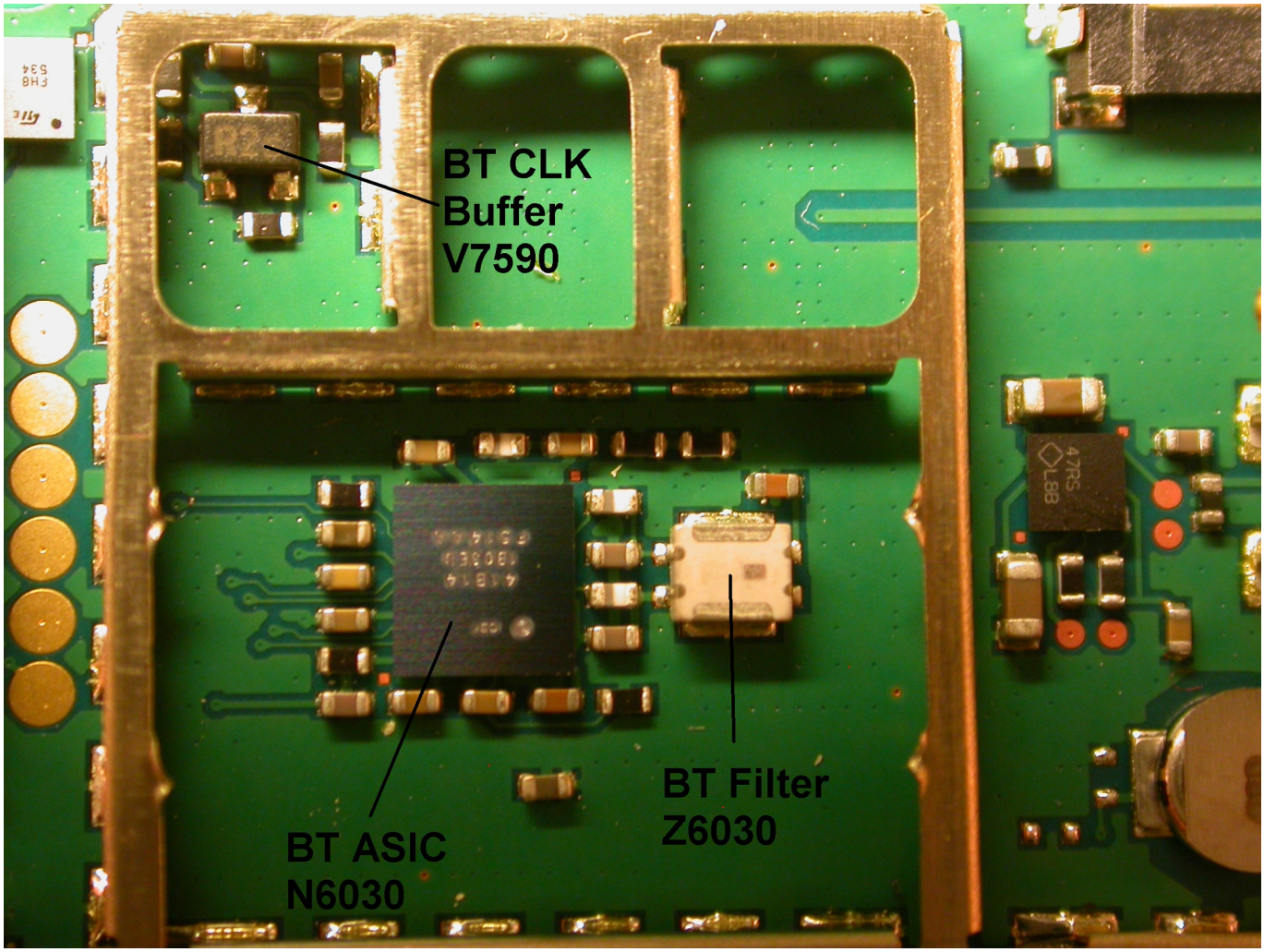


**Figure 48 RM-178 BT component placement**


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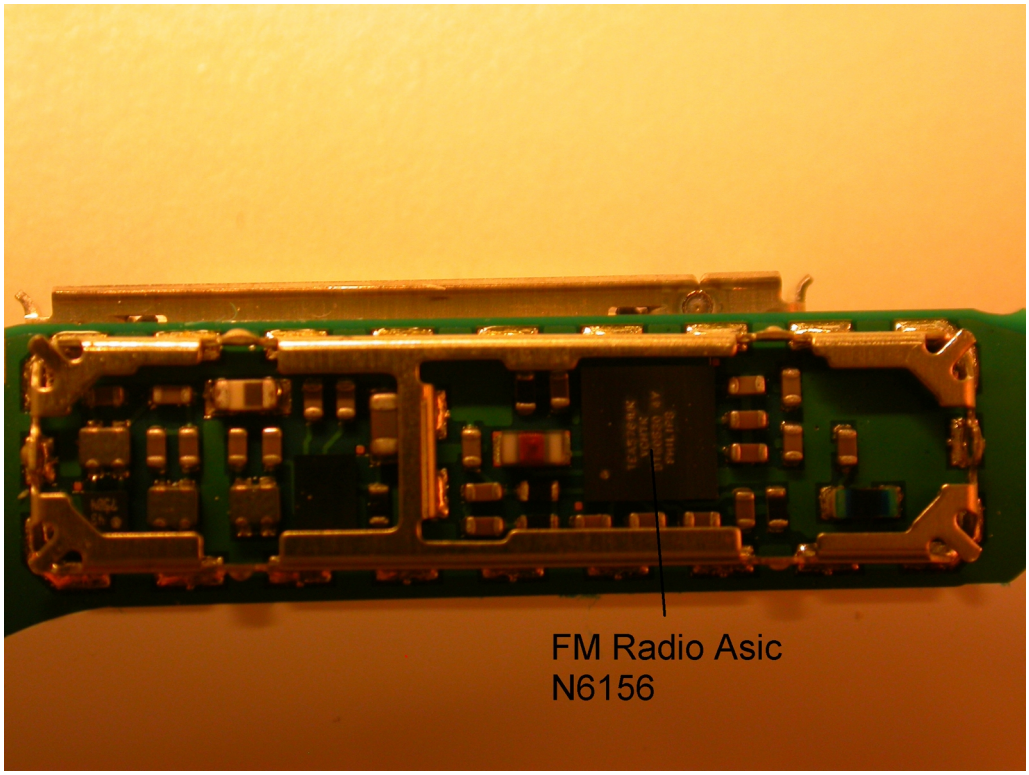


**Figure 49 RM-178 FM component placement**

## Receiver troubleshooting

### Introduction to RX troubleshooting

Rx can be tested by making a phone call or in the local mode. For the local mode testing, use Phoenix service software.

The main Rx troubleshooting measurement is RSSI measurement. This test measures the signal strength of the received signal. I and Q branches can be measured separately.

In GSM, the input signal can be either a real GSM signal or a CW signal that is 67.771kHz up from the carrier frequency.

For service tool usage instructions, refer to section Service Tools and Service Concepts.

### General instructions for RX troubleshooting

#### Steps

1. Connect a test jig to a computer with a DKU-2 cable or to a FPS-10 flash prommer with a modular cable (XCS-4).

   Make sure that you have a PKD-1 dongle connected to the computer's parallel port.
2. Connect a DC power supply to a module test jig (MJ-77).

   **Note:** Set the DC supply voltage to 12 V and set the jumper connector on the test jig's **reg.pass** switch to “ON” position.
3. Connect an RF cable between the RF connector of the phone and measurement equipment or alternatively use a 50 ohms (at least 2W) dummy, otherwise GSM may be damaged.

   **Note:** Make sure that all connections are made to the correct RF connector and correct type of RF probe is used.
4. Set Rx on.


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i Set the phone module to the test jig and start *Phoenix service software*.

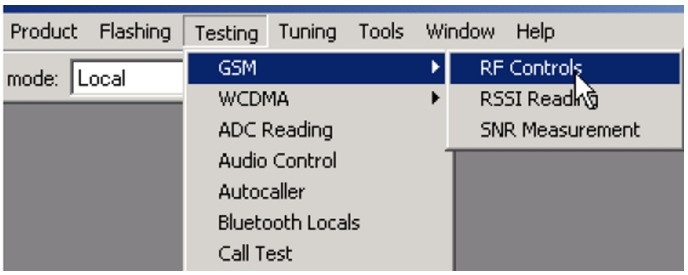
ii Initialize connection to the phone. (With FPS-10 use FBUS driver when using DKU-2 and COMBOX driver).

iii From the File menu, choose product: **File -> Choose Product -> xx-x*** (* = type designator of the phone, scan product).

iv From the toolbar, set operating mode to "Local".

5. EGSM900, GSM850/1800/1900 troubleshooting

i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls** .




ii In the *RF Controls* window:

- Select band "GSM850", "GSM900" or "GSM1800" or "GSM1900" (Default = "GSM850").
- Set Active unit to "Rx" (Default = "Rx").
- Set Operation mode to "Burst" (Default = "Burst").
- Set Rx/Tx channel to 190 on GSM850, 37 on GSM900 band or 700 on GSM1800 band or 661 on GSM1900 (Defaults).
- Set Edge to "Off" (Default). (Not active in RXmode).
- Set Tx PA mode to "Free" (Default). (Not active in RXmode).
- Apply 942.46771 MHz (channel 37 + 67.710 kHz offset), 881.66771MHz (channel 190 + 67.710 kHz), 1842.86771 MHz (channel 700 + 67.710 kHz offset) or 1960.06771 MHz (channel 661 + 67.71 kHz) –90 dBm signal to the RF-connector (remember to compensate for cable attenuation).

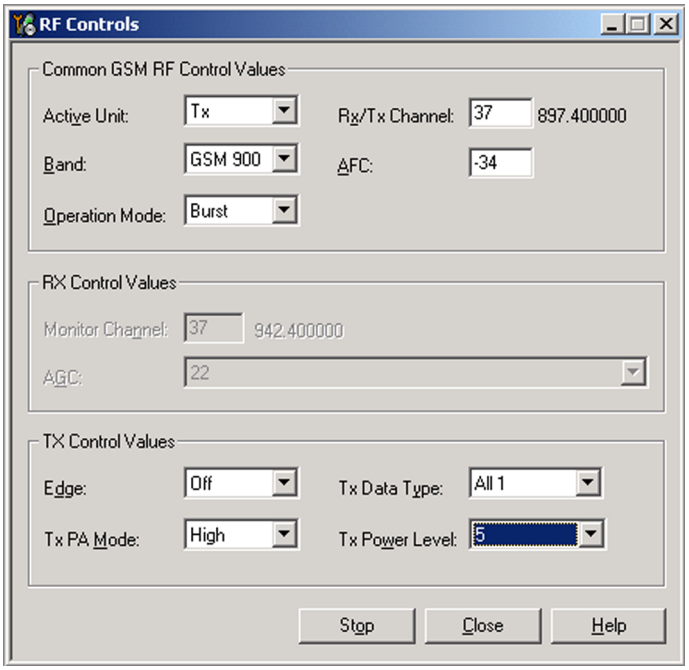



**Figure 50 RF Controls window**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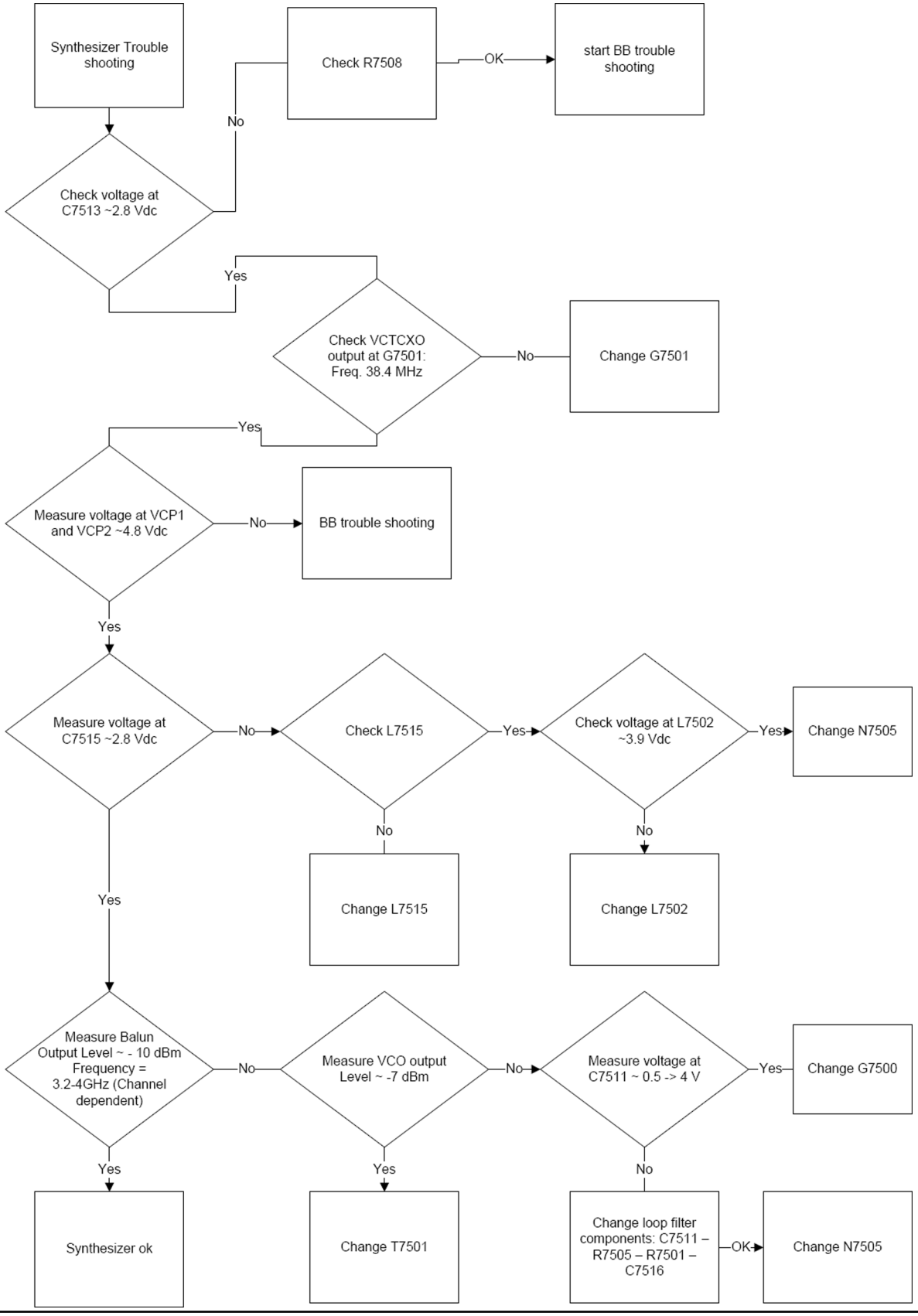
## Synthesizer troubleshooting

### Troubleshooting flow





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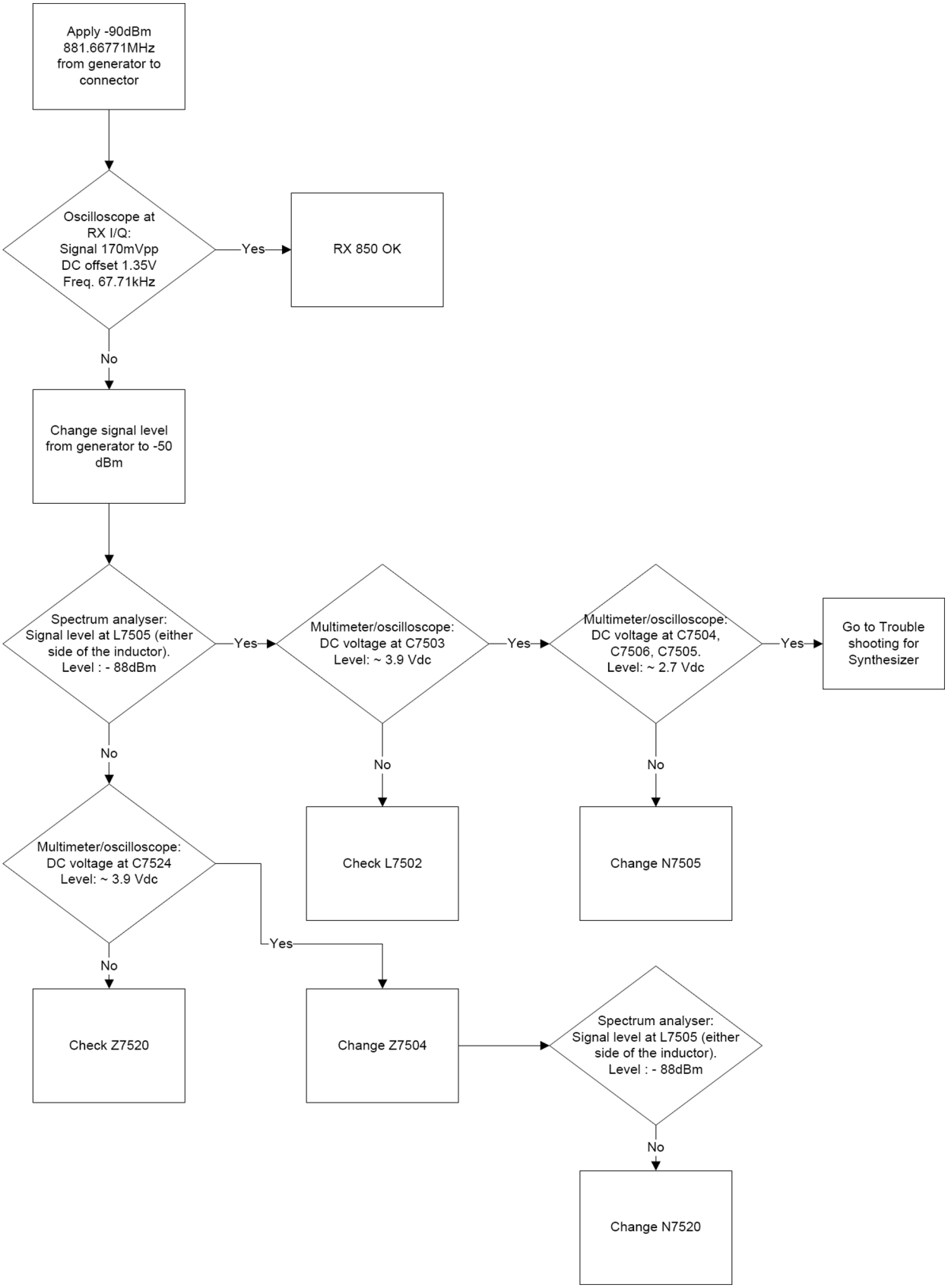
## GSM850 troubleshooting

### Troubleshooting flow





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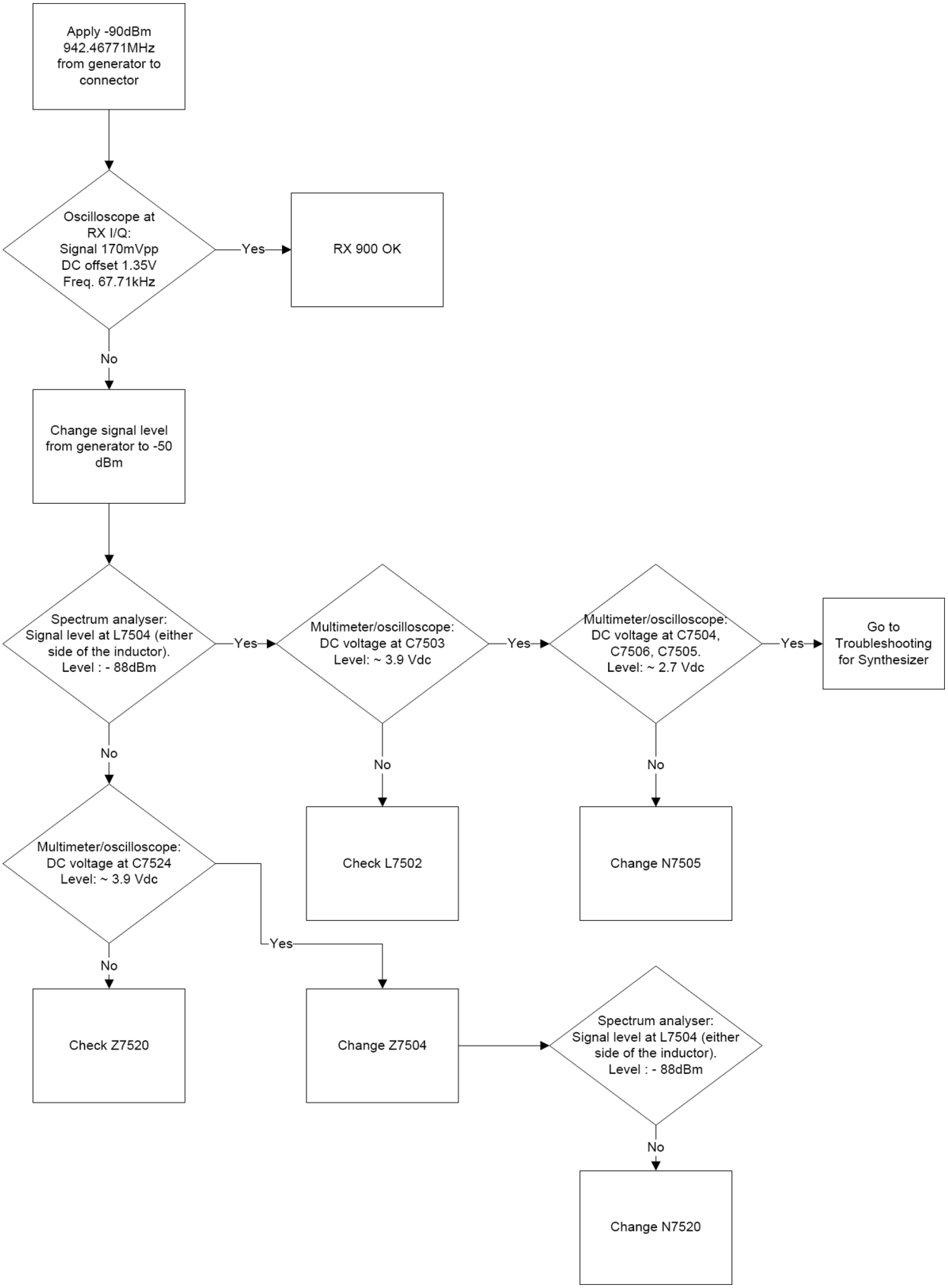
## GSM900 troubleshooting

### Troubleshooting flow





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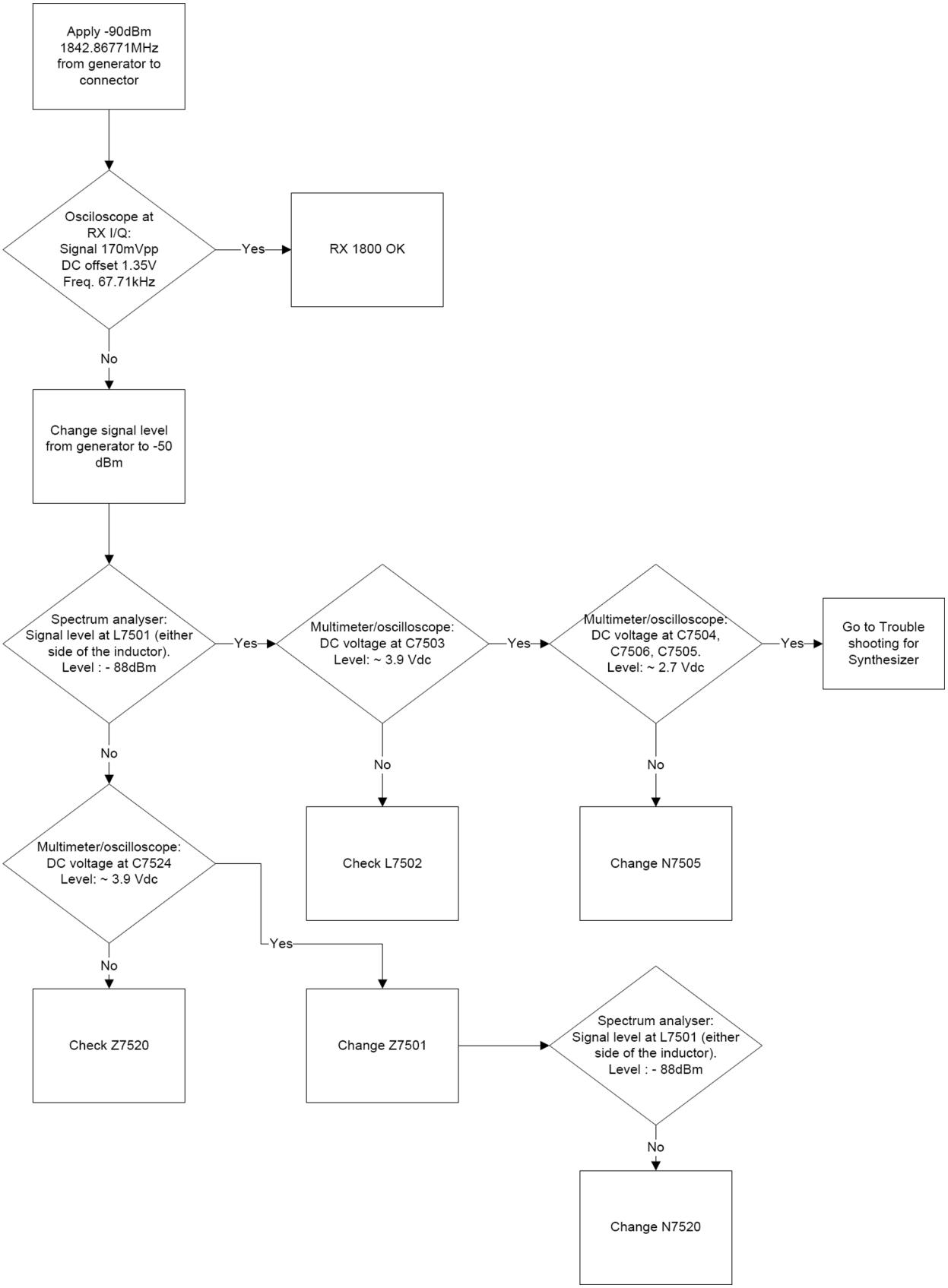
## GSM1800 troubleshooting

### Troubleshooting flow





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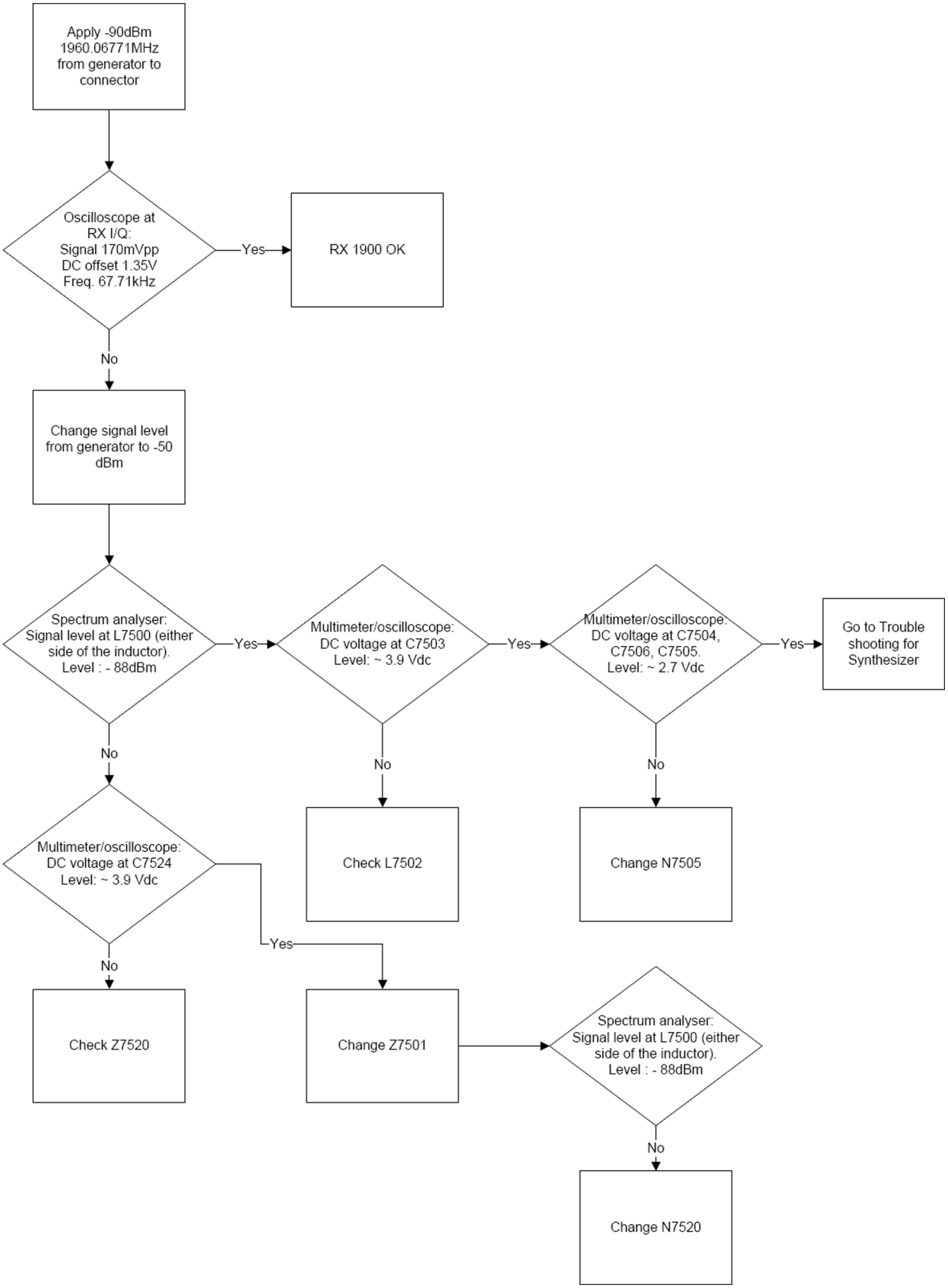
## GSM1900 troubleshooting

### Troubleshooting flow





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### GSM Rx chain activation for manual measurements / GSM RSSI measurement

## Context

RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

I and Q branches can be measured separately. In GSM, the input signal can be either real GSM signal or a CW (Continuous Wave) signal that is 67.771 kHz above the carrier frequency.

## Steps

1. Start *Phoenix* service software.
2. Choose **Testing→GSM→RSSI Reading** .
3. Set the RF signal generator for channel frequency +67.771 kHz CW mode with –80 dBm signal.

   Alternatively set the cellular tester downlink channel to the appropriate channel. Make sure that the tester is set to continuous mode, not to burst mode.
4. In the *RSSI Reading* window, select the appropriate band and channel.

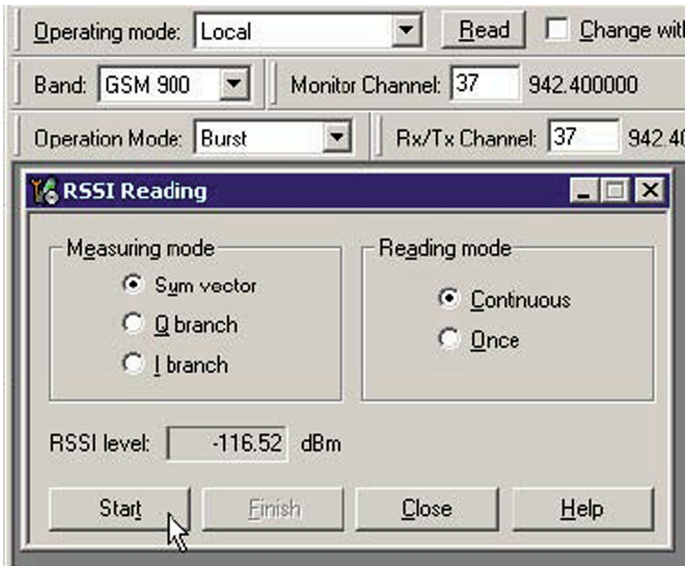


**Figure 51 *RSSI Reading* window**

5. To start the measurement, activate GSM Rx chain, click **Start**.

## Results

RSSI reading values of the selected band and channel are displayed. The RSSI level must be the same value which is set at the signal generator (-80 dBm).

# Transmitter troubleshooting

### General instructions for TX troubleshooting

## Context

- Tx troubleshooting requires Tx operation.
- Do not transmit on frequencies that are in use!
- Transmitter can be controlled in the local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is "RF Controls".


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- Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a fix! Phones are tuned correctly in production.

The first set of steps instructs how to assemble the test setup. This setup is general for all Tx troubleshooting tasks.

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software.

> **Caution:** Never activate the GSM transmitter without a proper antenna load. There should be always 50 ohm load connected to the RF connector (antenna, RF-measurement equipment or at least 2 watts dummy load), otherwise GSM PA may be damaged.

## Steps

1. Connect a test jig to a computer with a DKU-2 cable or to a FPS-10 flash prommer with a modular cable (XCS-4).

   Make sure that you have a PKD-1 dongle connected to the computer's parallel port.

2. Connect a DC power supply to a module jig (MJ-77).

   > **Note:** When repairing or tuning a transmitter, use an external DC supply with at least 3 A current capability.

   Set the DC supply voltage to 12V and set the jumper connector on the test jig's **reg.pass** switch to “ON” position.

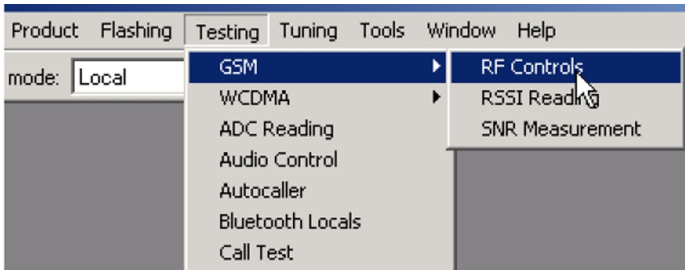
3. Connect an RF cable between the RF connector of the phone and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy, otherwise GSM may be damaged.

   > **Note:** Make sure that all connections are made to the correct RF connector and correct type of RF probe is used.

   Normally a spectrum analyser is used as measurement equipment.

   > **Note:** The maximum input power of a spectrum analyser is +30 dBm.
   >
   > To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.

4. Set Tx on.
   i Set the phone module to the test jig and start *Phoenix service software*.
   ii Initialize connection to the phone. (With FPS-10 use FBUS driver when using DAU-9S and COMBOX driver).
   iii From the File menu, choose product: **File -> Choose Product -> xx-x*** (* = type designator of the phone).
   iv From the toolbar, set operating mode to “Local”.
5. EGSM900, GSM850/1800/1900 troubleshooting
   i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls** .




   ii In the *RF Controls* window:
   - Select band "GSM850", “GSM900” or “GSM1800” or “GSM1900” (Default = “GSM850”).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- Set Active unit to “Tx” (Default = “Rx”).
- Set Operation mode to “Burst” (Default = “Burst”).
- Set Tx data type to “Random” (Default = “All1”).
- Set Rx/Tx channel to 190 on GSM850, 37 on GSM900 band or 700 on GSM1800 band or 661 on GSM1900 (Defaults).
- Set Edge to “Off” (Default).
- Set Tx PA mode to “Free” (Default).
- Set power level to 5 (Default = 19) on GSM850/900 or to 0 (Default = 15) on GSM1800 or GSM1900.

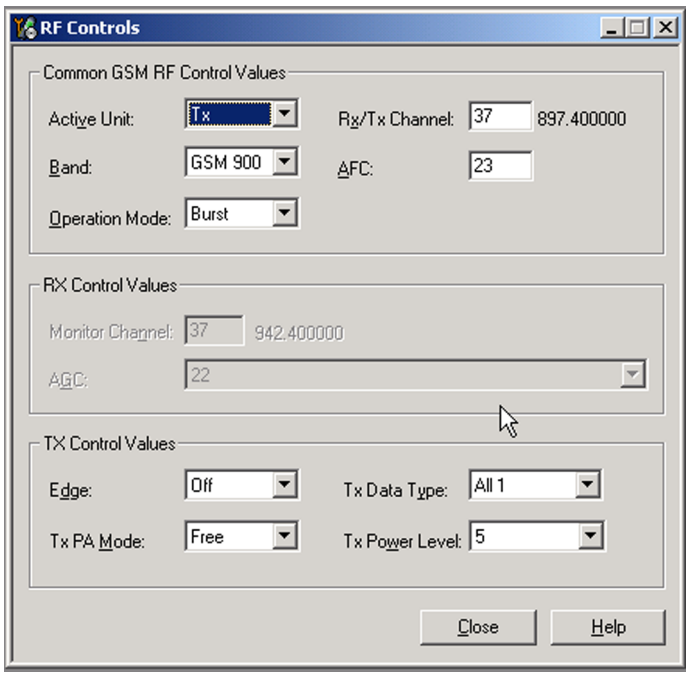


**Figure 52 RF Controls window**


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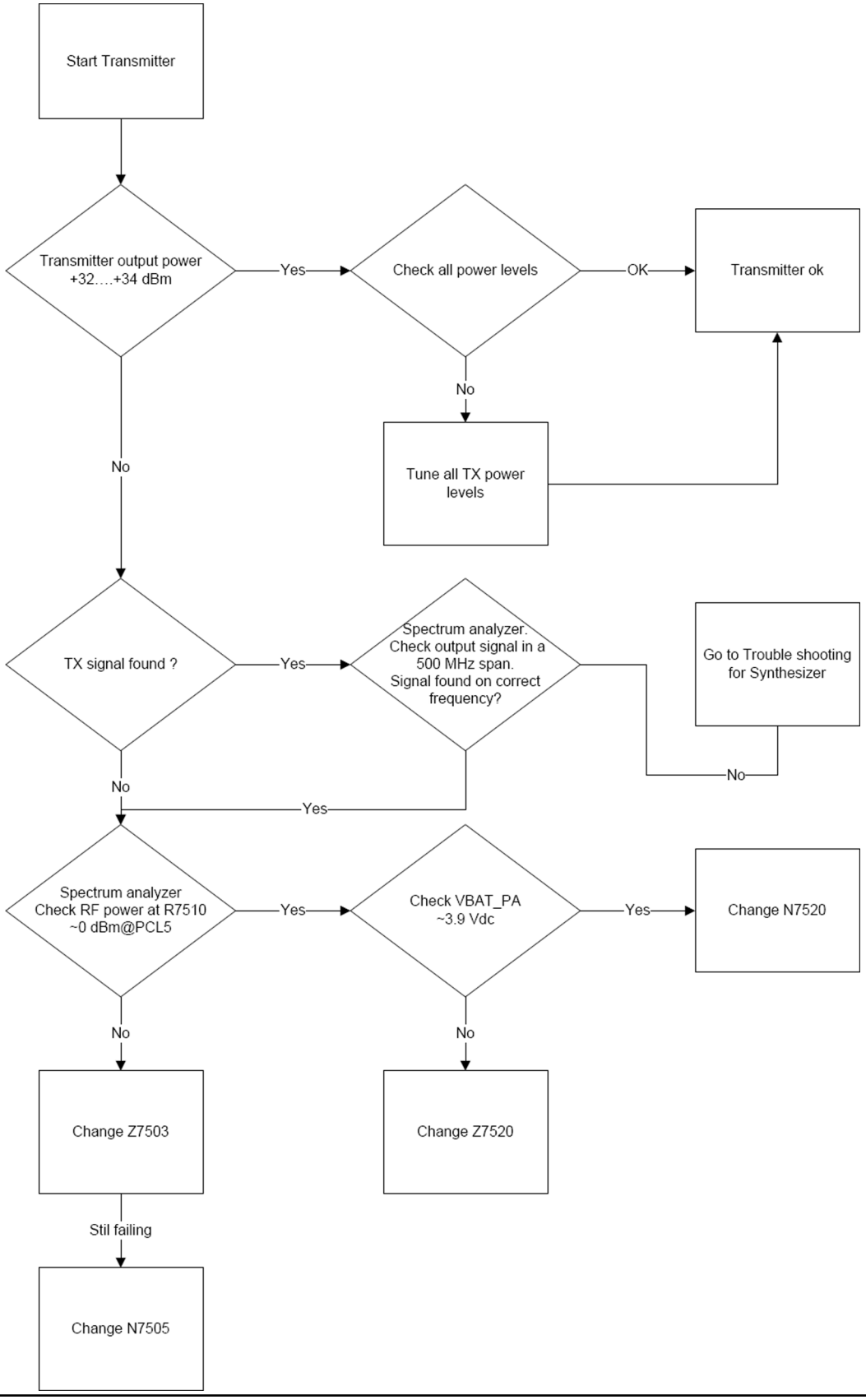
## TX 850/900 troubleshooting

### Troubleshooting flow





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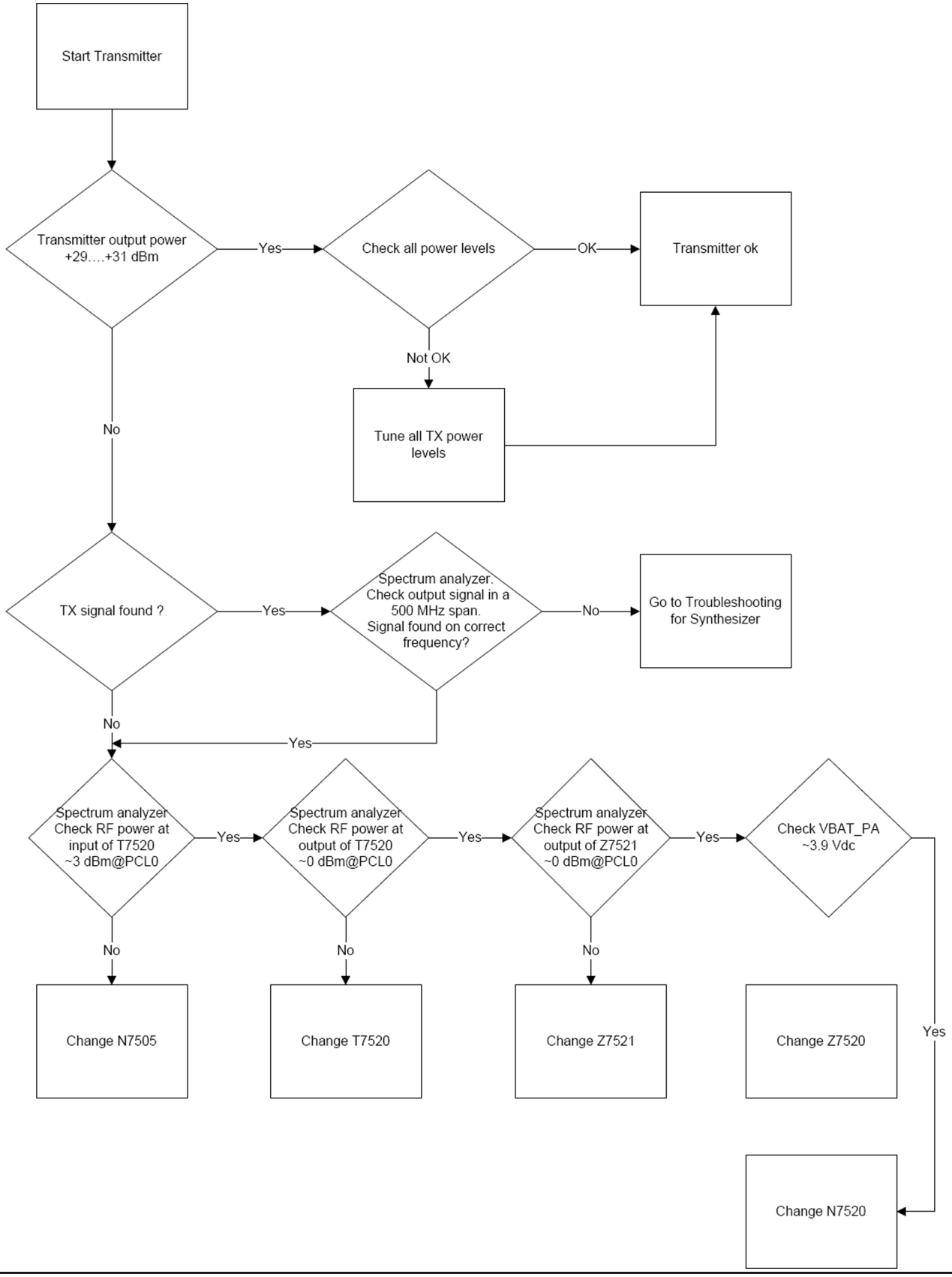
## TX 1800/1900 troubleshooting

### Troubleshooting flow





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### Checking antenna functionality

The main antenna has one antenna: GSM.

In the GSM antenna, there is one feed and one GND contact.

The antenna is functioning normally when it is visually intact and the antenna pins are intact.

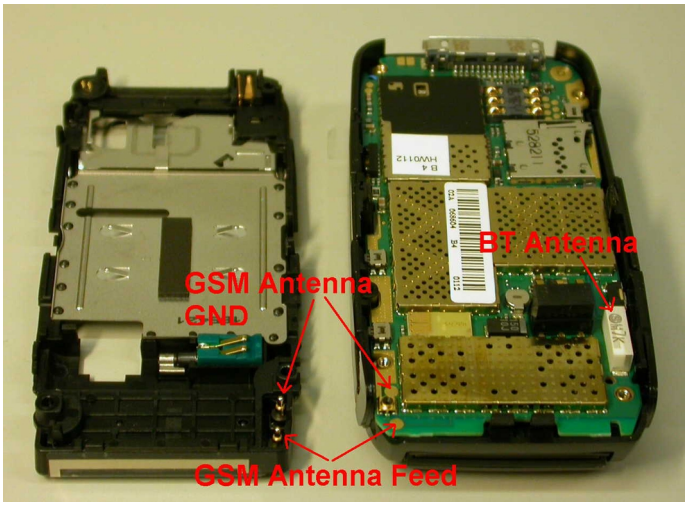


**Figure 53 Main antenna, feed and GND spots of the main antenna**

## BT antenna

BT antenna is a ceramic SMD antenna. The antenna is functioning normally when the contacts function (RDC = 0 ohm) and the antenna is visually intact.

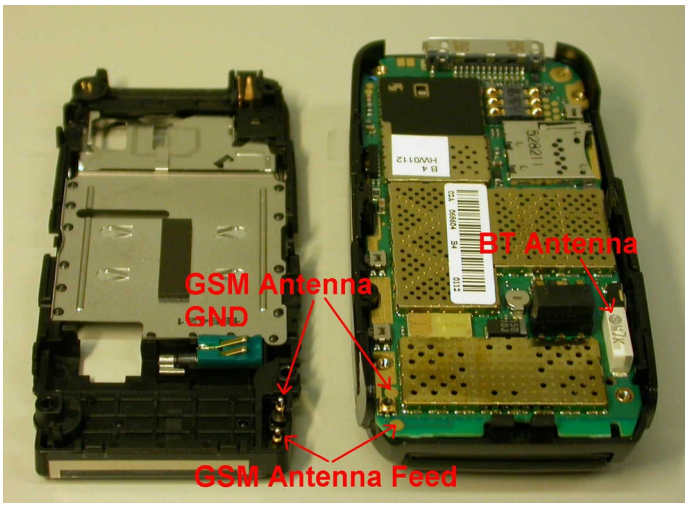


**Figure 54 BT antenna**

# RF tunings

### Introduction to RF tunings

**Important:** Only perform RF tunings if:

- one or more of the RF components is changed
- flash Memory chip is changed or otherwise corrupted.

RF calibration is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF side.


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**Important:** After RF component changes, **always** use autotuning. Manual tunings are only required in rare cases.

## Cable and adapter losses

RF cables and adapters have some losses. They have to be taken in account when the phone is tuned. As all the RF losses are frequency dependent, the user have to be very careful and understand the measurement setup. In the following table there are RF attenuations of the module jig:

| Band | Attenuation |
|---|---|
| GSM850 | 0.2 dB |
| GSM900 | 0.2 dB |
| GSM1800 | 0.3 dB |
| GSM1900 | 0.3 dB |

# RF autotuning

## Prerequisites

For information on the recommended test set-up, refer to the corresponding information on PWS/NOL.

Before you can use the auto-tune feature, the GPIB driver from the GPIB card vendor must be installed and running.

The autotune **.ini** file must be in a correct place: **C:\Program Files\Nokia\Phoenix\products\xx-x*\autotune_xx-x*.ini** (**= indicates the type designator of the phone, e.g. RM-1*)

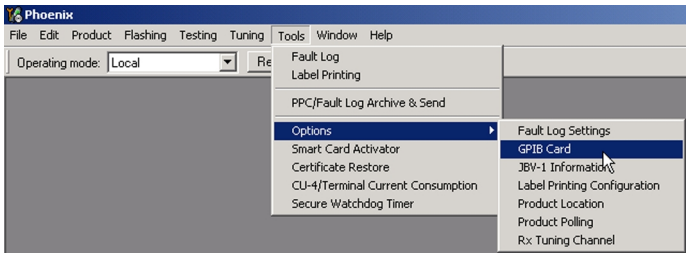
## Context

RF autotuning is performed with the aid of Digital Radio Communication Tester. Autotuning covers all RF tunings that are needed to perform after RF component repairs.

**Note:** Do not perform RF autotuning without a proper reason. Phones are tuned in production and an RF tuning may be performed only after component repairs or if the RF tuning information is lost.

## Steps

1. Connect the communication tester to the GPIB bus.
2. Start Phoenix service software.
3. From the Tools menu, choose Options -> GPIB Card.




4. In the Card Type line, select CEC8Bit, then click Start.

   After clicking Start, the name of the communication tester appears in the list of found Listeners.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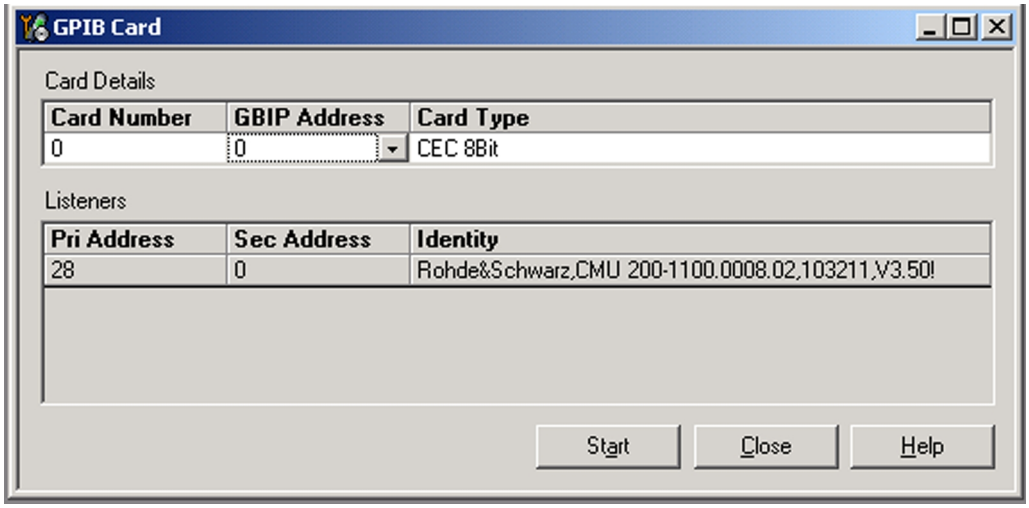
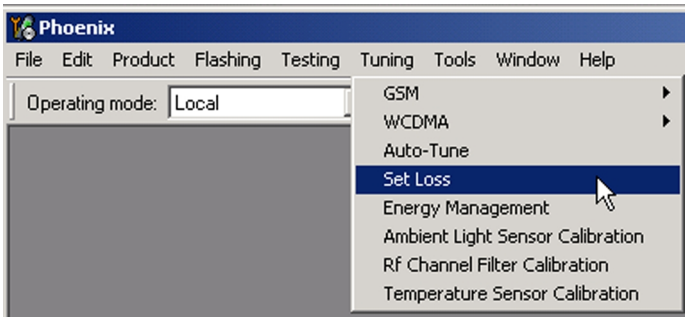
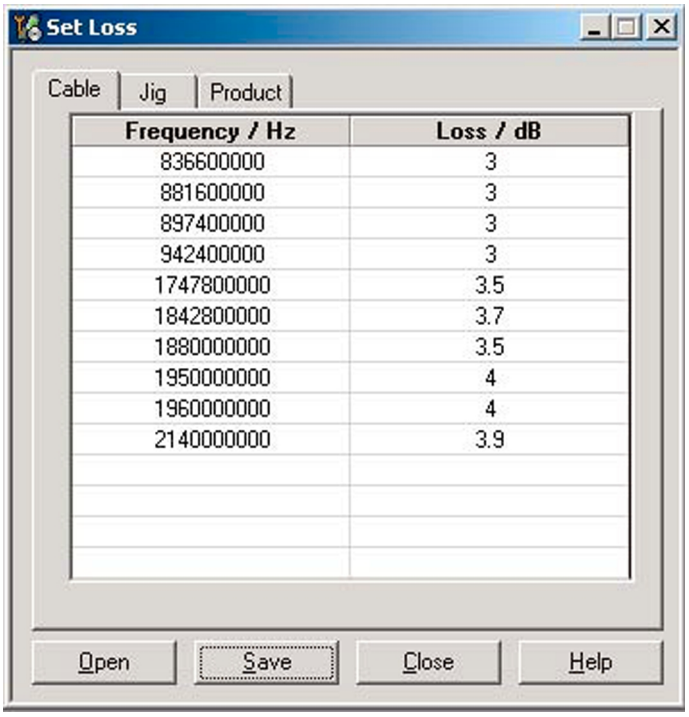



5. To specify the cable loss from module jig to the communication tester, choose "Set Loss" from the Tuning menu.




6. Click the Cable tab and add the extra cable attenuation.

**Note:** Cable losses have to be determined on the basis of a cable used.





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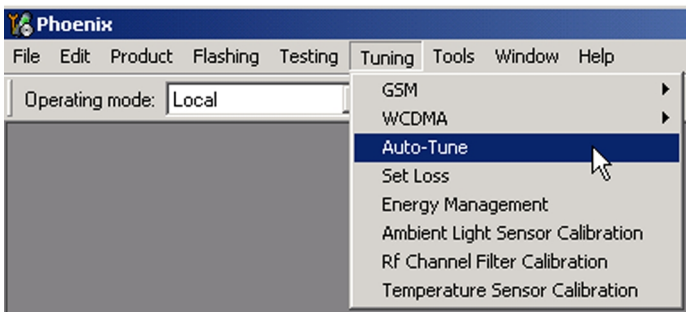
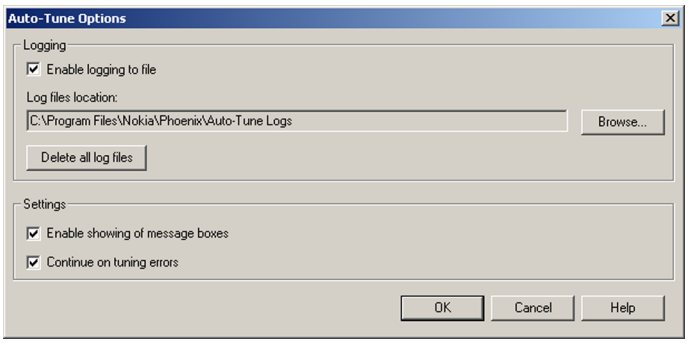
7. To start autotuning, choose Auto-Tune from the Tuning menu.



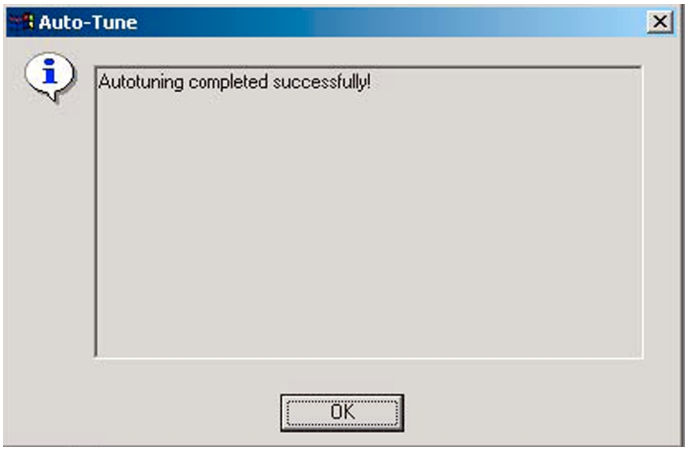

8. In the Auto-Tune window, click Options.
9. In the Auto-Tune options window, see that the "Enable showing of messages" check box is checked, then click OK.




10. To complete the RF autotuning, click OK.

## Results

"Autotuning completed successfully" message appears.




# System mode independent manual tunings

## Rf channel filter calibration

## Context

Rf channel filter calibration tunes the internal low pass filters of Rx and Tx ASICs that limit the bandwidth of BB IQ signals.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One common calibration is made for GSM.

**Table 13 Rf channel filter calibration tuning limits**

| | Min | Typ | Max |
|---|---|---|---|
| Tx filter | 0 | 10 | 31 |
| Rx filter | 0 | 16 | 31 |

### Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→Rf Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

### Results

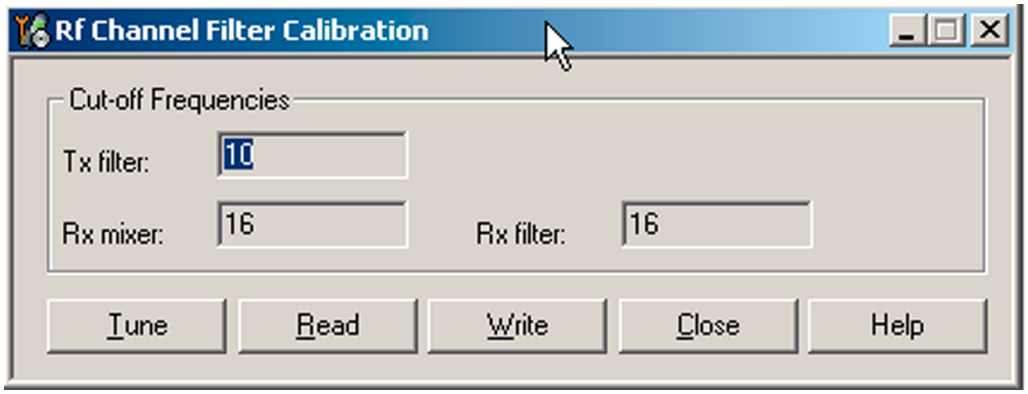


**Figure 55 Rf channel filter calibration typical values**

## PA (power amplifier) detection

### Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

### Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→PA Detection** .
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.


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## GSM receiver tunings

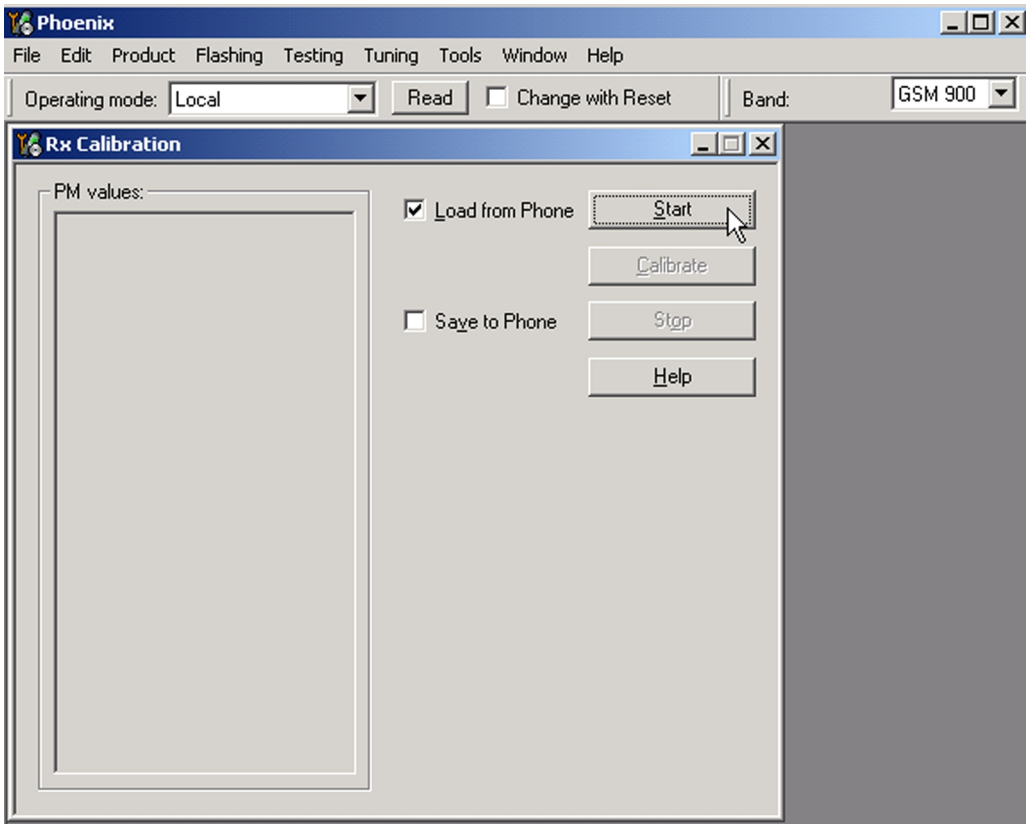
### Rx calibration (GSM)

#### Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

#### Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Rx Calibration** .
5. Check the **Load from Phone** check box, and uncheck **Save to Phone**.
6. From the **Band** drop-down menu, choose e.g. **GSM900**.
7. Click **Start**.





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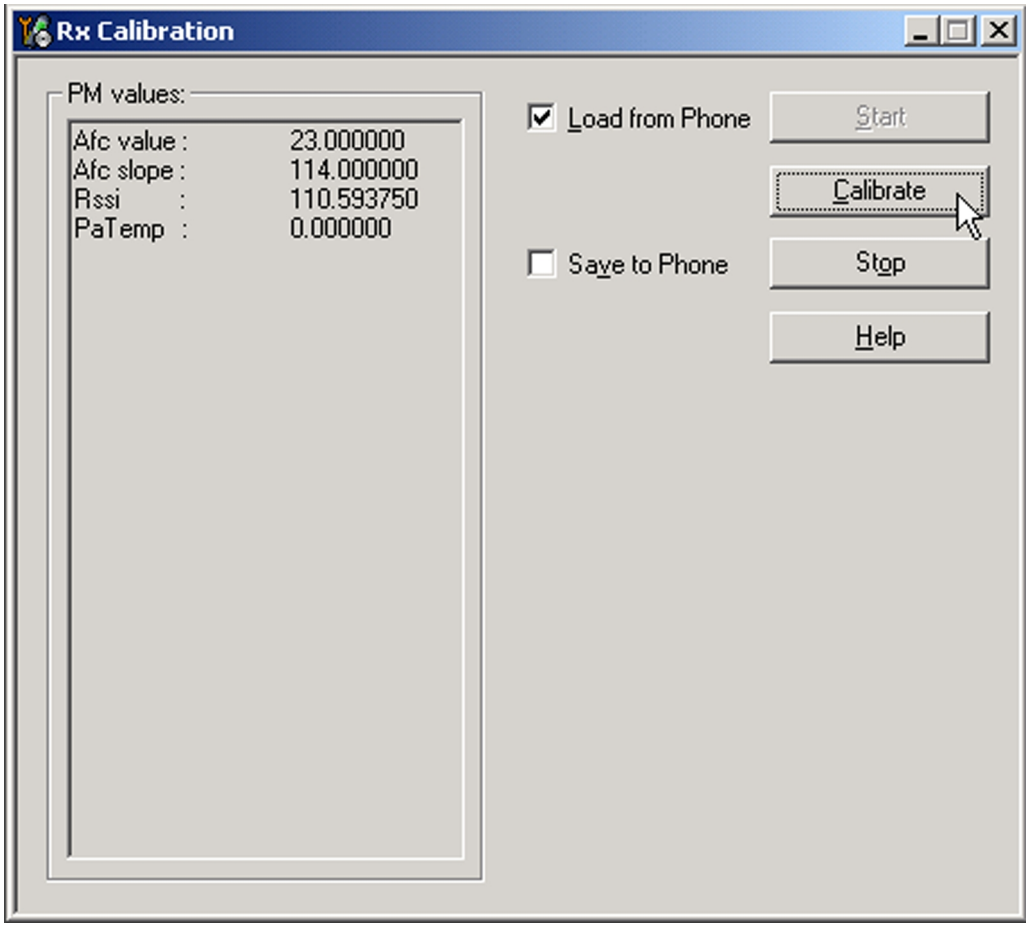
8. Click **Calibrate**.




9. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** pop-up window.

   **Important:** The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation.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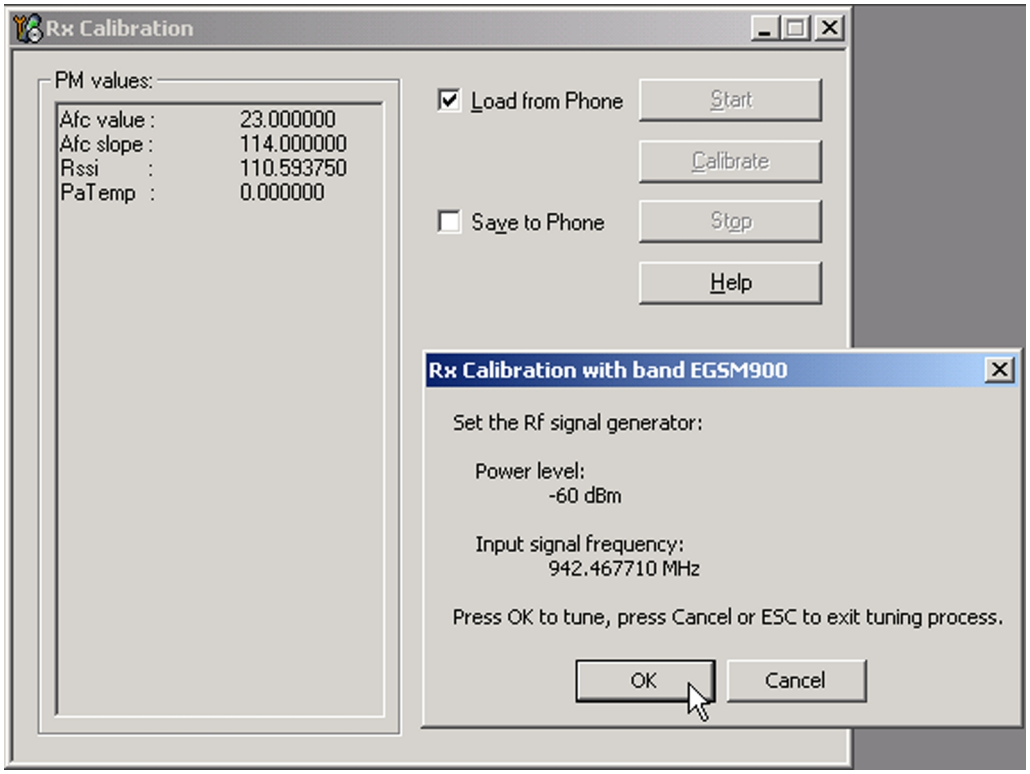


10. To perform the tuning, click **OK**.
11. Check that the tuning values are within the limits specified in the following table:

**Table 14 RF tuning limits in Rx calibration**

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| **GSM850** | | | | |
| AFC Value | -200 | -105...62 | 200 | |
| AFC slope | 0 | 122 | 200 | |
| RSSI0 | 106 | 107...110 | 114 | dB |
| **GSM900** | | | | |
| AFC Value | -200 | -105...62 | 200 | |
| AFC slope | 0 | 122 | 200 | |
| RSSI0 | 106 | 107...110 | 114 | dB |
| **GSM1800** | | | | |
| RSSI0 | 104 | 104...109 | 114 | dB |
| **GSM1900** | | | | |
| RSSI0 | 104 | 104...109 | 114 | dB |


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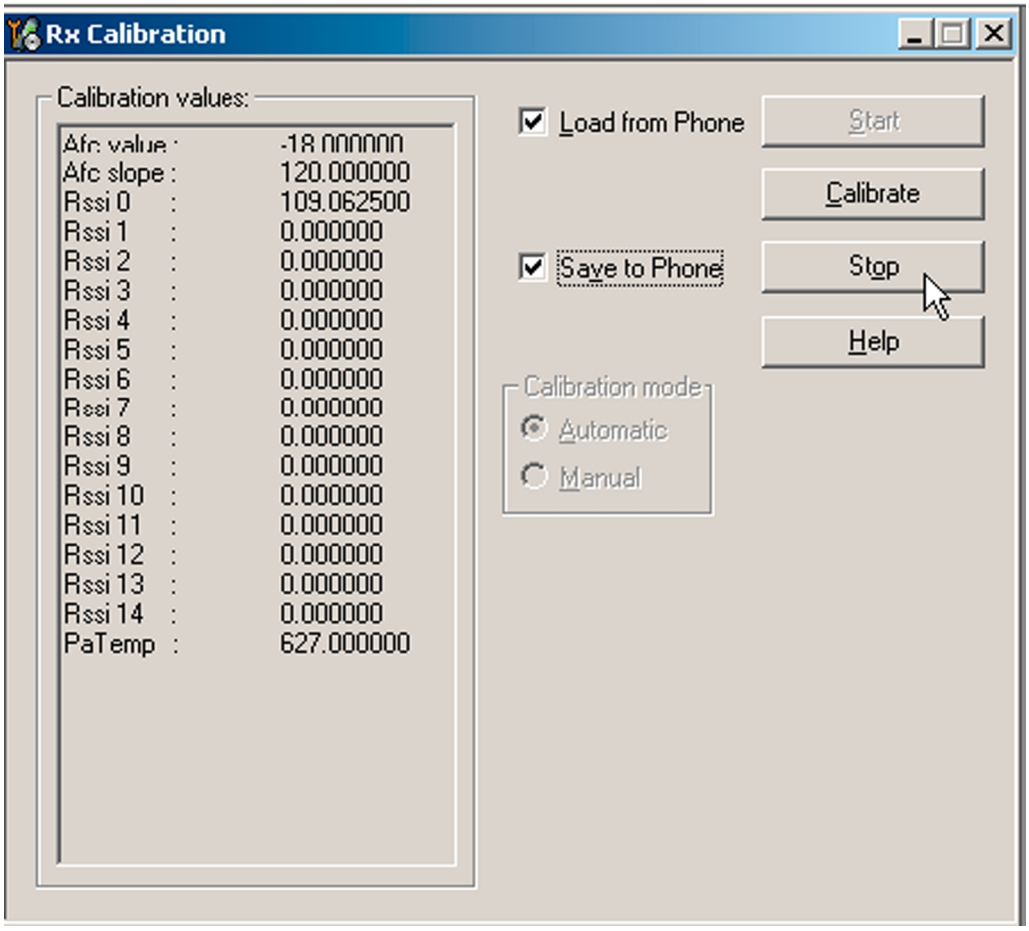
12. To save values to the phone, check the **Save to Phone** check box, and click **Stop**.




## Next actions

Repeat steps 3 to 8 for GSM850, GSM1800 and GSM1900

## Rx band filter response compensation (GSM)

## Prerequisites

Rx calibration must be done before the Rx Band Filter Response Compensation

## Context

In each GSM Rx band, there's a band rejecting filter in front of RF ASIC front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

## Steps

1. Connect module jig's GSM connector to signal generator.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.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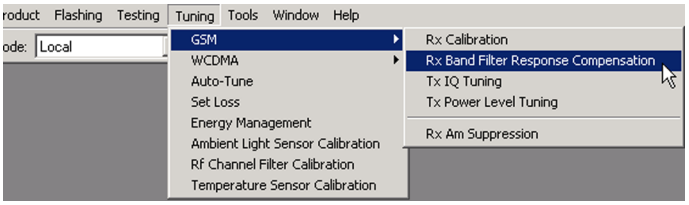
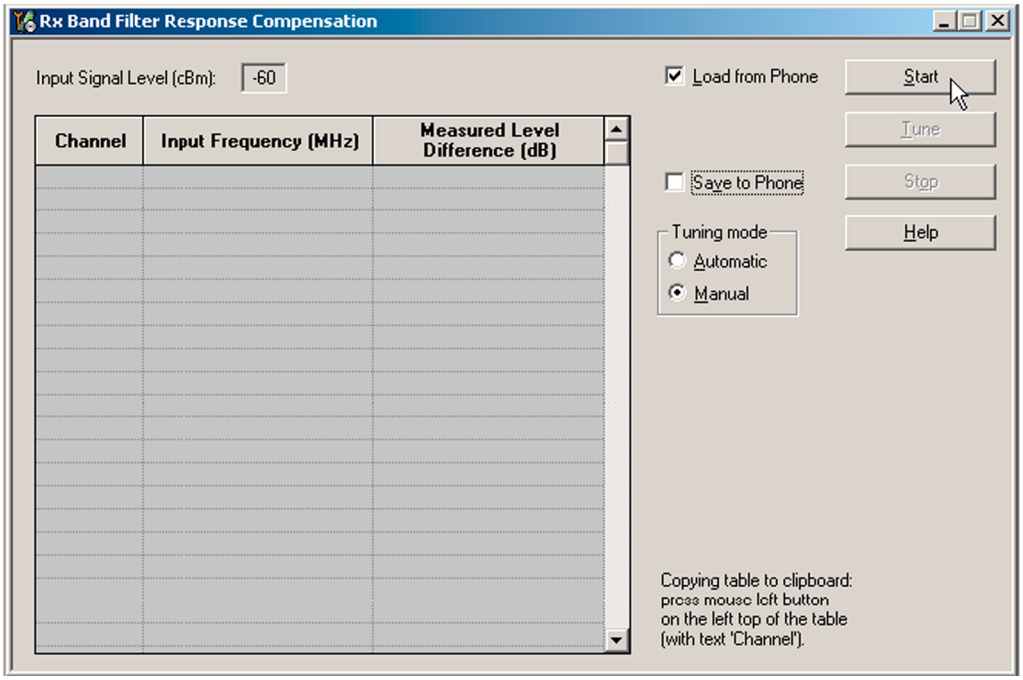
3. From the Tuning menu, choose GSM -> Rx Band Filter Response Compensation.




4. Check “Manual” and “Load from Phone” check boxes. Clear “Save to Phone” check box
5. Click Start.





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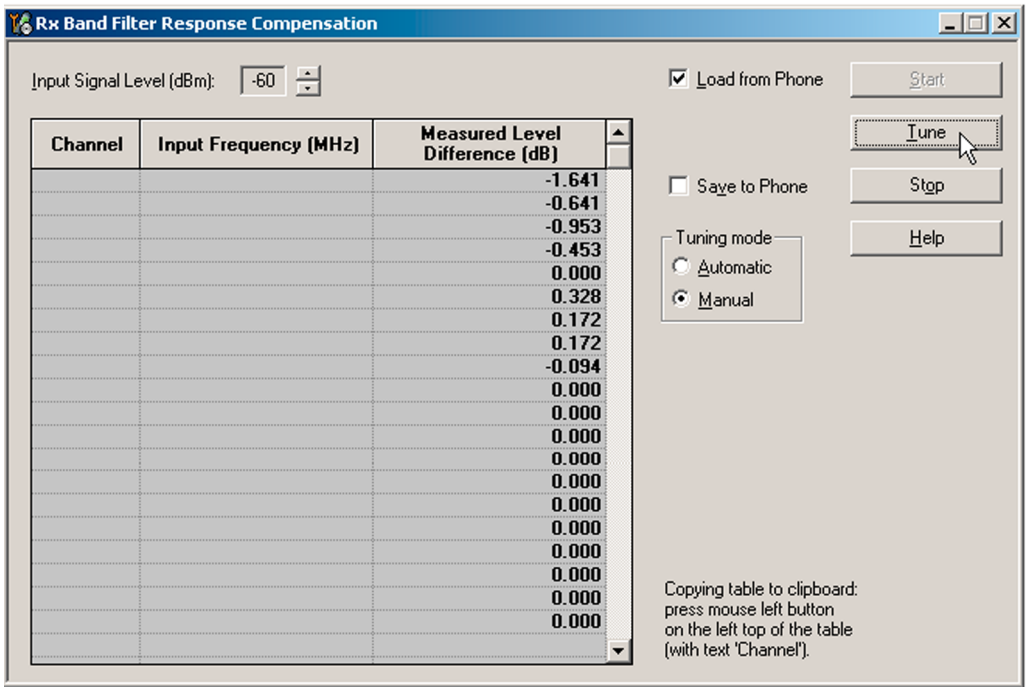
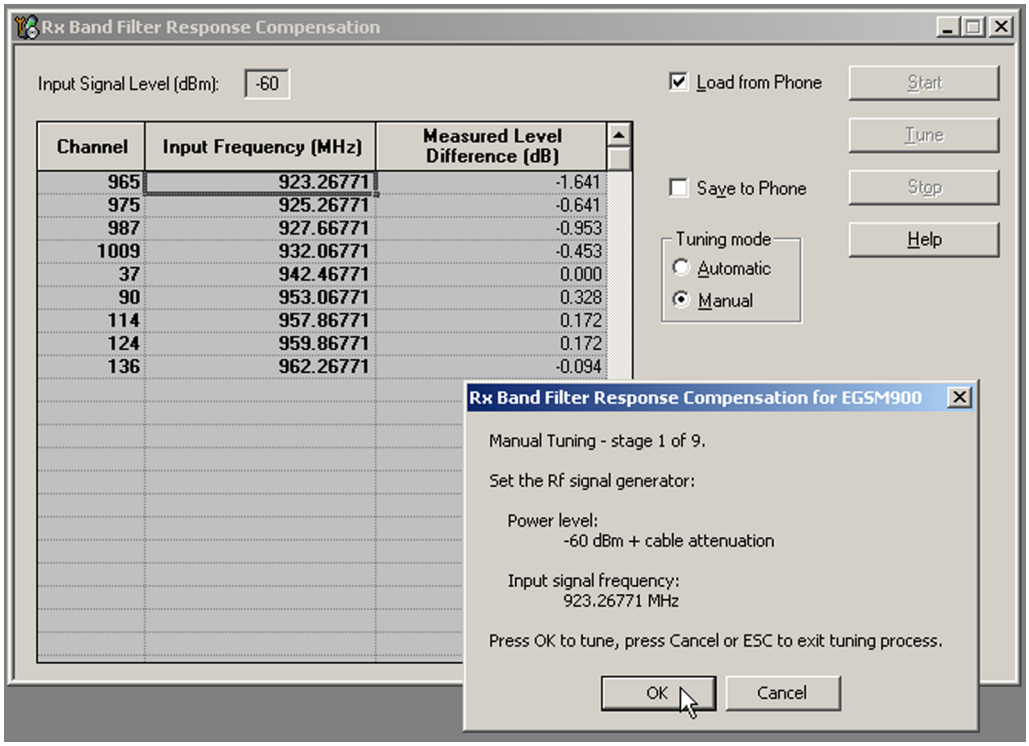
6. Click Tune.




7. Connect signal generator to the phone and set frequency and amplitude as instructed in the "Rx Band Filter Response Compensation for EGSM900" popup window.




8. To perform tuning, click OK.
9. Go through all 9 frequencies.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10. Check that the tuning values are within the limits specified in this table:

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| **GSM850** | | | | |
| Ch. 118 / 867.26771 MHz | -10 | -1 | 5 | dB |
| Ch. 128 / 869.26771 MHz | -3 | 0 | 5 | dB |
| Ch. 140 / 871.66771 MHz | -3 | 0 | 5 | dB |
| Ch. 172 / 878.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 190 / 881.66771 MHz | -3 | 0 | 5 | dB |
| Ch. 217 / 887.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 241 / 891.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 251 / 893.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 261/ 895.86771 MHz | -10 | -1 | 5 | dB |
| **GSM900** | | | | |
| Ch. 965 / 923.26771 MHz | -10 | -1 | 5 | dB |
| Ch. 975 / 925.26771 MHz | -3 | 0 | 5 | dB |
| Ch. 987 / 927.66771 MHz | -3 | 0 | 5 | dB |
| Ch. 1009 / 932.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 37 / 942.46771 MHz | -3 | 0 | 5 | dB |
| Ch. 90 / 953.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 114 / 957.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 124 / 959.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 136 / 962.26771 MHz | -10 | -1 | 5 | dB |
| **GSM1800** | | | | |


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| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Ch. 497 / 1802.26771 MHz | -10 | -1 | 5 | dB |
| Ch. 512 / 1805.26771 MHz | -3 | 0 | 5 | dB |
| Ch. 535 / 1809.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 606 / 1824.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 700 / 1842.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 791 / 1861.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 870 / 1876.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 885 / 1879.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 908 / 1884.46771 MHz | -10 | -1 | 5 | dB |
| **GSM1900** | | | | |
| Ch. 496 / 1927.06771 MHz | -10 | -1 | 5 | dB |
| Ch. 512 / 1930.26771 MHz | -3 | 0 | 5 | dB |
| Ch. 537 / 1935.26771 MHz | -3 | 0 | 5 | dB |
| Ch. 586 / 1945.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 661 / 1960.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 736 / 1975.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 794 / 1986.66771 MHz | -3 | 0 | 5 | dB |
| Ch. 810 / 1989.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 835 / 1994.86771 MHz | -10 | -1 | 5 | dB |


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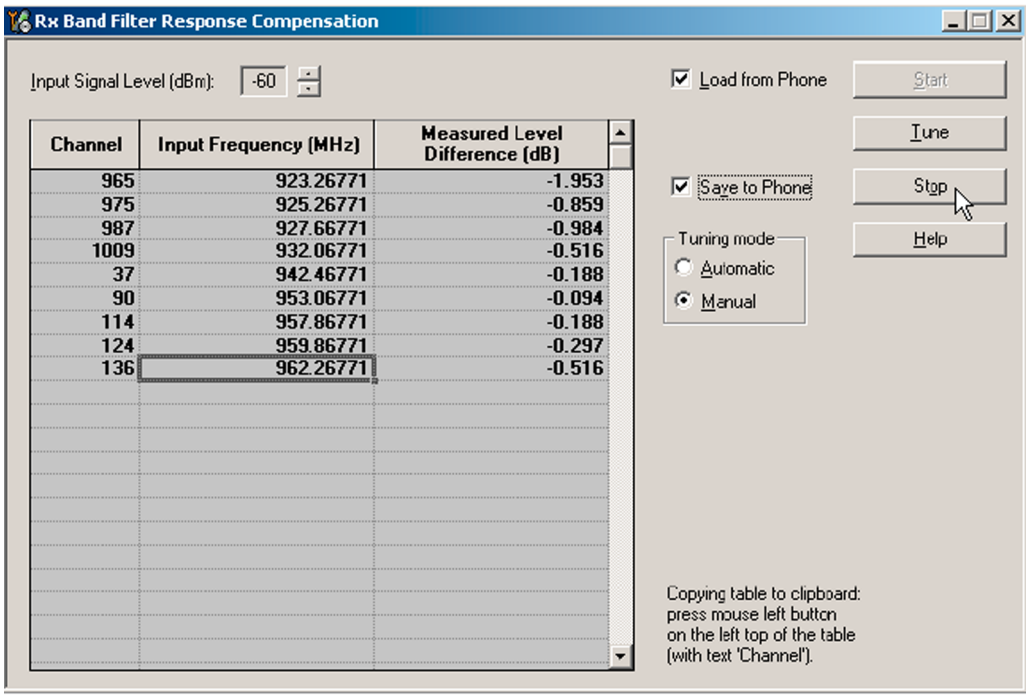
11. Check the "Save to Phone" check box and click Stop if the values are within the limits.




## Next actions

Repeat the steps 4 to 10 for GSM850, GSM1800 and GSM1900.

# GSM transmitter tunings

## Tx IQ tuning (GSM)

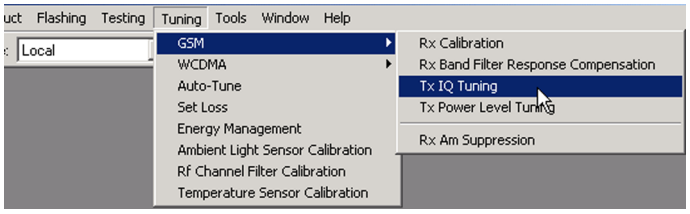
## Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning tuning balances the I and Q branches.

Tx IQ tuning must be performed on all GSM bands. .

## Steps

1. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.
2. From the Tuning menu, choose GSM -> Tx IQ Tuning.




3. Set Mode to Automatic and Edge to Off.
4. Click Start.

   Wait until automatic tuning has finished and moved the sliders.

   Values are written to the phone memory automatically.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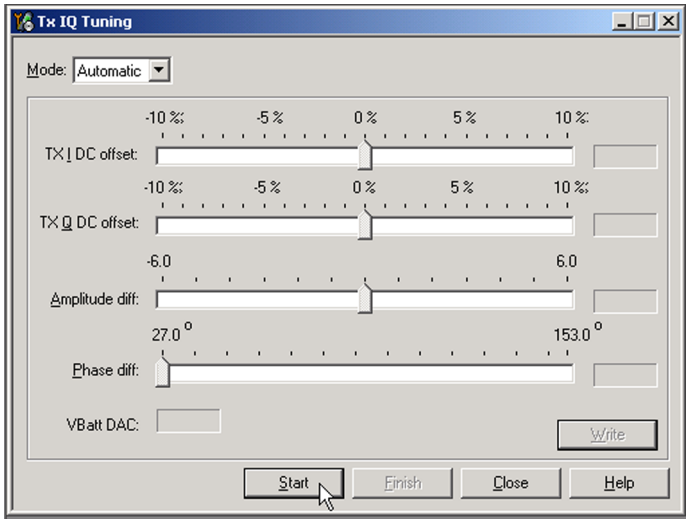
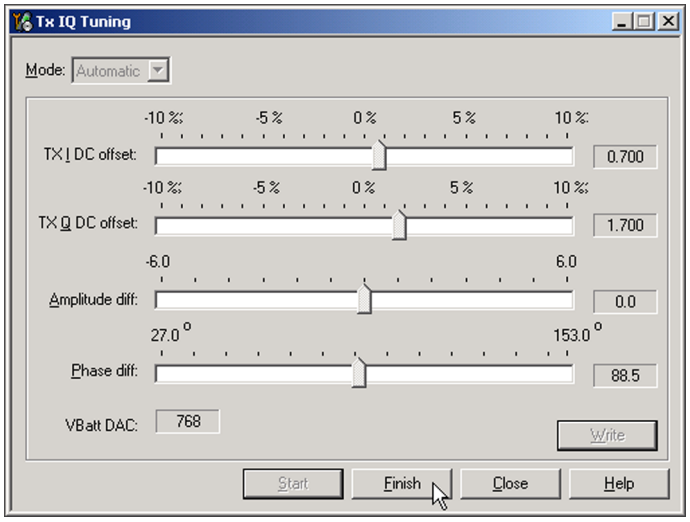



5. When the values have been written to the phone memory, click the Finish button to end the tuning.




6. Change band to GSM850 and repeat steps 4 to 5.
7. Change band to GSM1800 and repeat steps 4 to 5.
8. Change band to GSM1900 and repeat steps 4 to 5.
9. To close the tuning window, click Close.

## Next actions

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the table below. If they are not within the limits, check Tx IQ quality manually.

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| **GSM850** | | | | |
| I DC offset / Q DC offset | -6 | -4 | 6 | % |
| Ampl | -1 | 0 | 1 | dB |
| Phase | 85 | 90 | 95 | ○ |
| **GSM900** | | | | |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| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| I DC offset / Q DC offset | -6 | -4 | 6 | % |
| Ampl | -1 | 0 | 1 | dB |
| Phase | 85 | 90 | 95 | ○ |
| **GSM1800/GSM1900** | | | | |
| I/Q DC | -6 | 0.5 | 6 | % |
| Ampl | -1 | 0 | 1 | dB |
| Phase | 95 | 100 | 110 | ○ |

## Tx power level tuning (GSM)

### Context

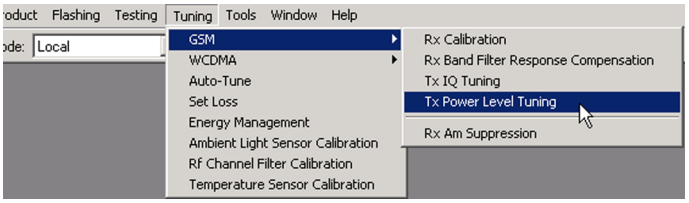
Because of variations at IC process and discrete component values, actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

For EDGE transmission the bias settings of the FEM are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

### Steps

1. Connect the phone to a spectrum analyzer.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.
3. From the Tuning menu, choose GSM -> Tx Power Level Tuning.




4. Set Mode to Automatic and Edge to Off.
5. Set the spectrum analyzer for power level tuning:

| | |
|---|---|
| Frequency | channel frequency (836.6MHz GSM850, 897.4MHz GSM900, 1747.8MHz GSM1800, 1880MHz GSM1900) |
| Span | 0 Hz |
| Sweep time | 2ms |
| Trigger | Video triggering (-10dBm) |
| Resolution BW | 3MHz |
| Video BW | 3MHz |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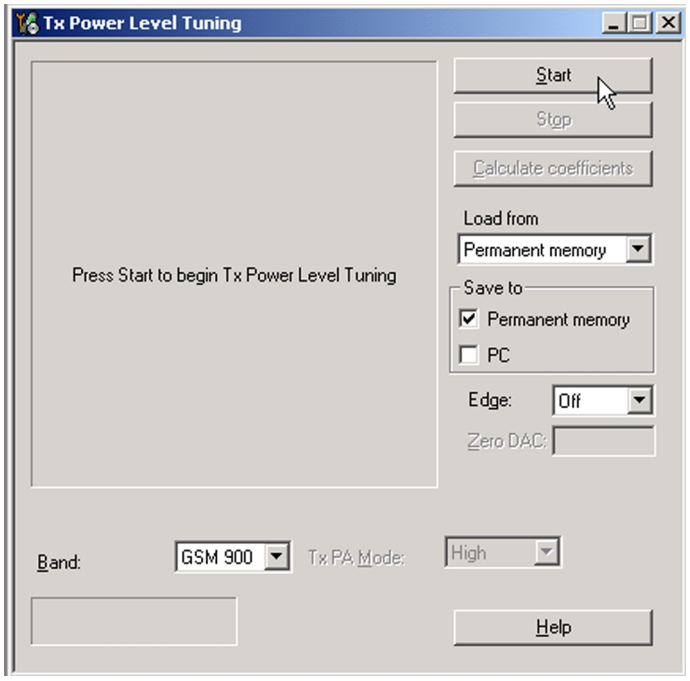
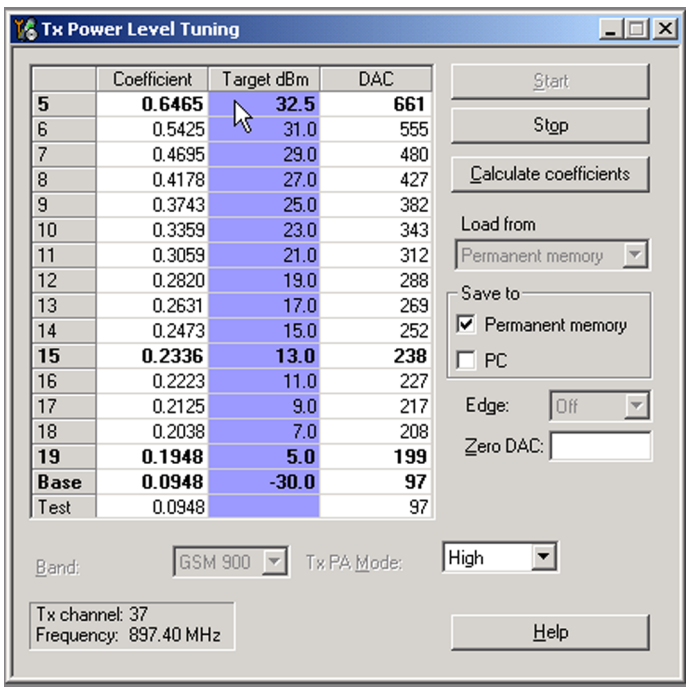
| | |
|---|---|
| Reference level offset | sum cable attenuation with module jig attenuation |
| Reference level | 33dBm |

A power meter with a peak power detector can be also used. Remember to take the attenuations in the account!

6. Click Start.




7. Adjust power levels 5, 15 and 19 to correspond the "Target dBm" column by pressing + or – keys.





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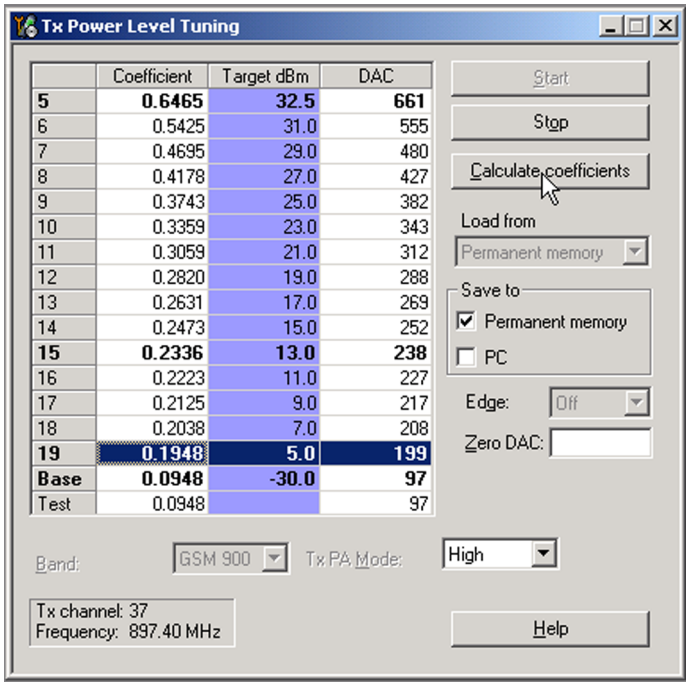
8. Click Calculate Coefficients.




9. Check that the coeffiecient values are within the limits specified in the following table.

| | Min | Typ | Max |
|---|---|---|---|
| **GSM850 EDGE off** | | | |
| PL5 coefficient | 0.45 | 0.626 | 0.73 |
| PL15 coefficient | | 0.234 | |
| PL19 coefficient | 0.12 | 0.195 | 0.3 |
| **GSM850 EDGE on** | | | |
| PL8 coefficient | 0.35 | 0.419 | 0.6 |
| PL15 coefficient | | 0.247 | |
| PL19 coefficient | 0.12 | 0.204 | 0.3 |
| **GSM900 EDGE off** | | | |
| PL5 coefficient | 0.45 | 0.626 | 0.73 |
| PL15 coefficient | | 0.234 | |
| PL19 coefficient | 0.12 | 0.195 | 0.3 |
| **GSM900 EDGE on** | | | |
| PL8 coefficient | 0.35 | 0.419 | 0.6 |
| PL15 coefficient | | 0.247 | |
| PL19 coefficient | 0.12 | 0.204 | 0.3 |
| **GSM1800 EDGE off** | | | |
| PL0 coefficient | 0.45 | 0.51 | 0.7 |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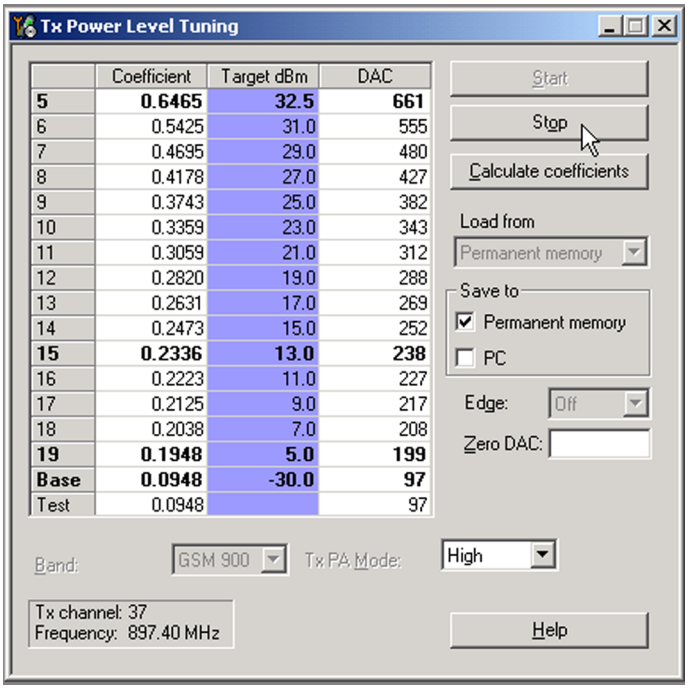
| | Min | Typ | Max |
|---|---|---|---|
| PL11 coefficient | | 0.219 | |
| PL15 coefficient | 0.12 | 0.185 | 0.3 |
| **GSM1800 EDGE on** | | | |
| PL2 coefficient | 0.35 | 0.394 | 0.6 |
| PL11 coefficient | | 0.23 | |
| PL15 coefficient | 0.12 | 0.194 | 0.3 |
| **GSM1900 EDGE off** | | | |
| PL0 coefficient | 0.45 | 0.482 | 0.7 |
| PL11 coefficient | | 0.218 | |
| PL15 coefficient | 0.12 | 0.184 | 0.3 |
| **GSM1900 EDGE on** | | | |
| PL2 coefficient | 0.35 | 0.377 | 0.6 |
| PL11 coefficient | | 0.23 | |
| PL15 coefficient | 0.12 | 0.193 | 0.3 |

If the values are within the limits, check that the "Save to Phone Permanent Memory" check box is checked and click Stop.





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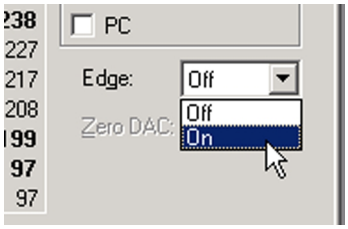
10. Set **Edge** mode on and start tuning again. Change video averaging to 50.




11. Tune EDGE power levels to the corresponding target power levels.

    Only power levels **8**, **15** and **19** are tuned in GSM900 and **2**, **10** and **15** in GSM1800/1900. The rest are calculated by clicking the Calculate Coefficients button. Check the coefficients against the RF tuning limits table presented in Step 9.

12. When the tuning is completed, click Stop.

## Next actions

Repeat steps 4 to 9 for GSM1800 and GSM1900. On those bands only power levels **0**, **11** and **15** need to be tuned.

# RM-106/199 WLAN troubleshooting

## Introduction to WLAN troubleshooting

The main problem that can occur is malfunction in WLAN or WLAN ASICs or WLAN SMD components. Such problems are unpredictable and may have many causes, either HW or SW related.

> **Note:** While WLAN power tuning is not possible without power meter especially capable for measuring WLAN wideband power, WLAN ICs (WLAN IC and WLAN front-end module) shall not be changed.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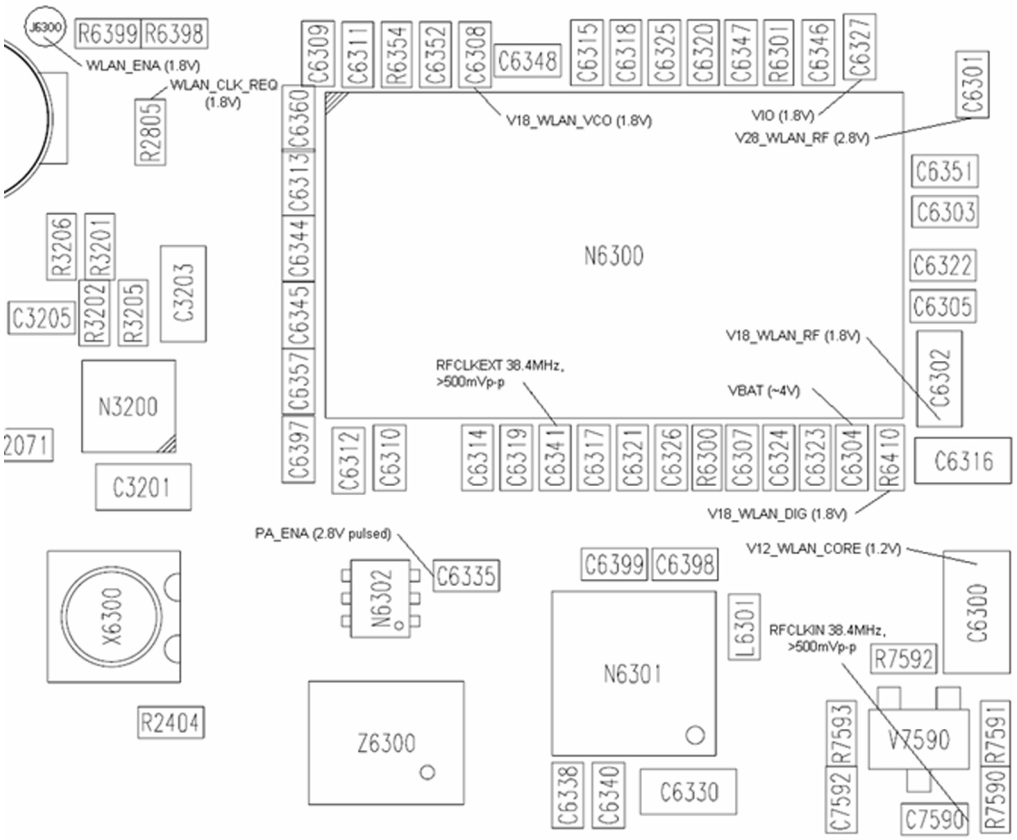


**Figure 56 WLAN layout**


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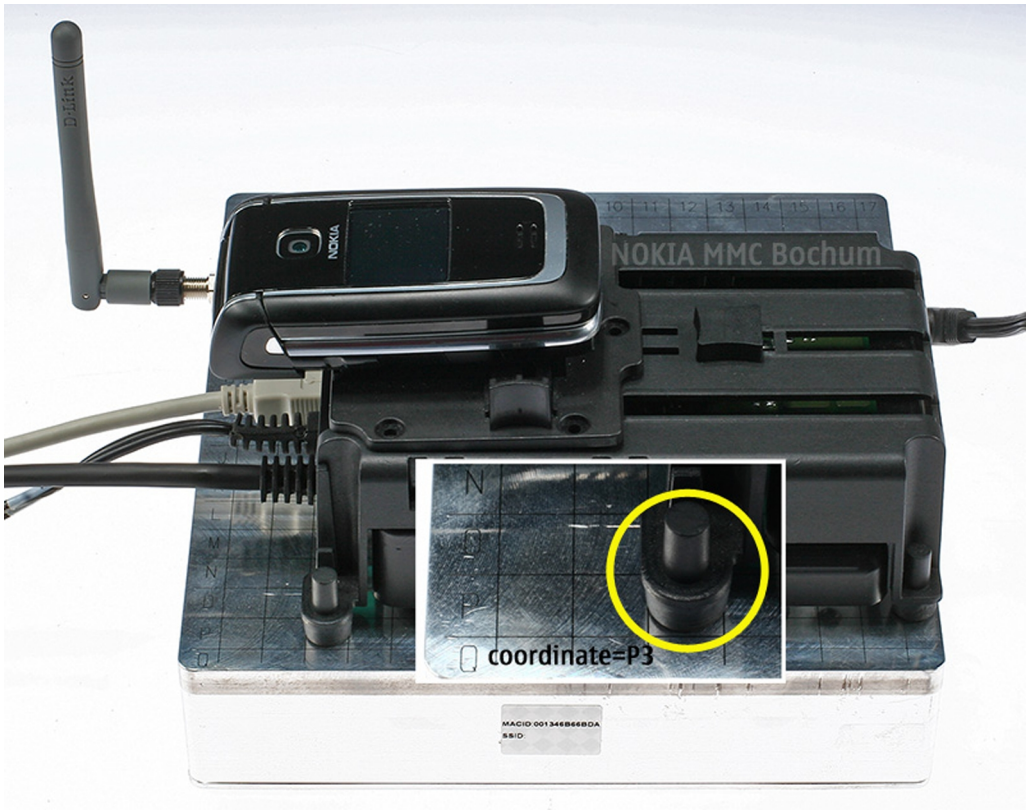
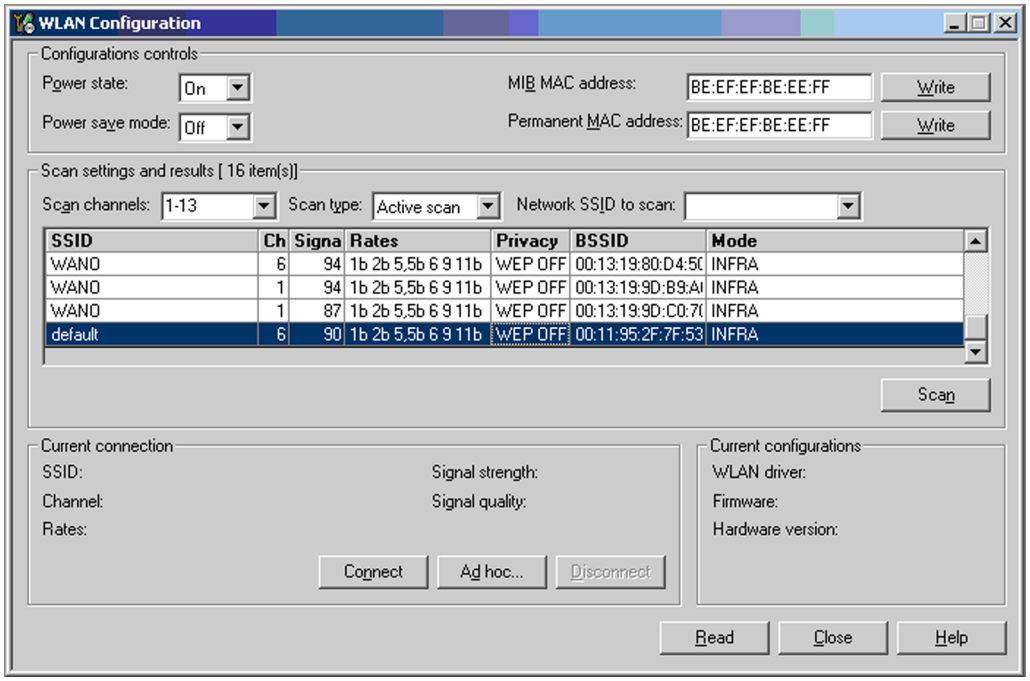
## WLAN functionality test using SB-7 and Phoenix

### Steps

1. Place the phone on the SB-7 WLAN test box, see figure below.




2. Start *Phoenix* service software and turn the phone to the local mode.
3. From the **Testing** menu, choose **WLAN Configuration**. The following window should come up:





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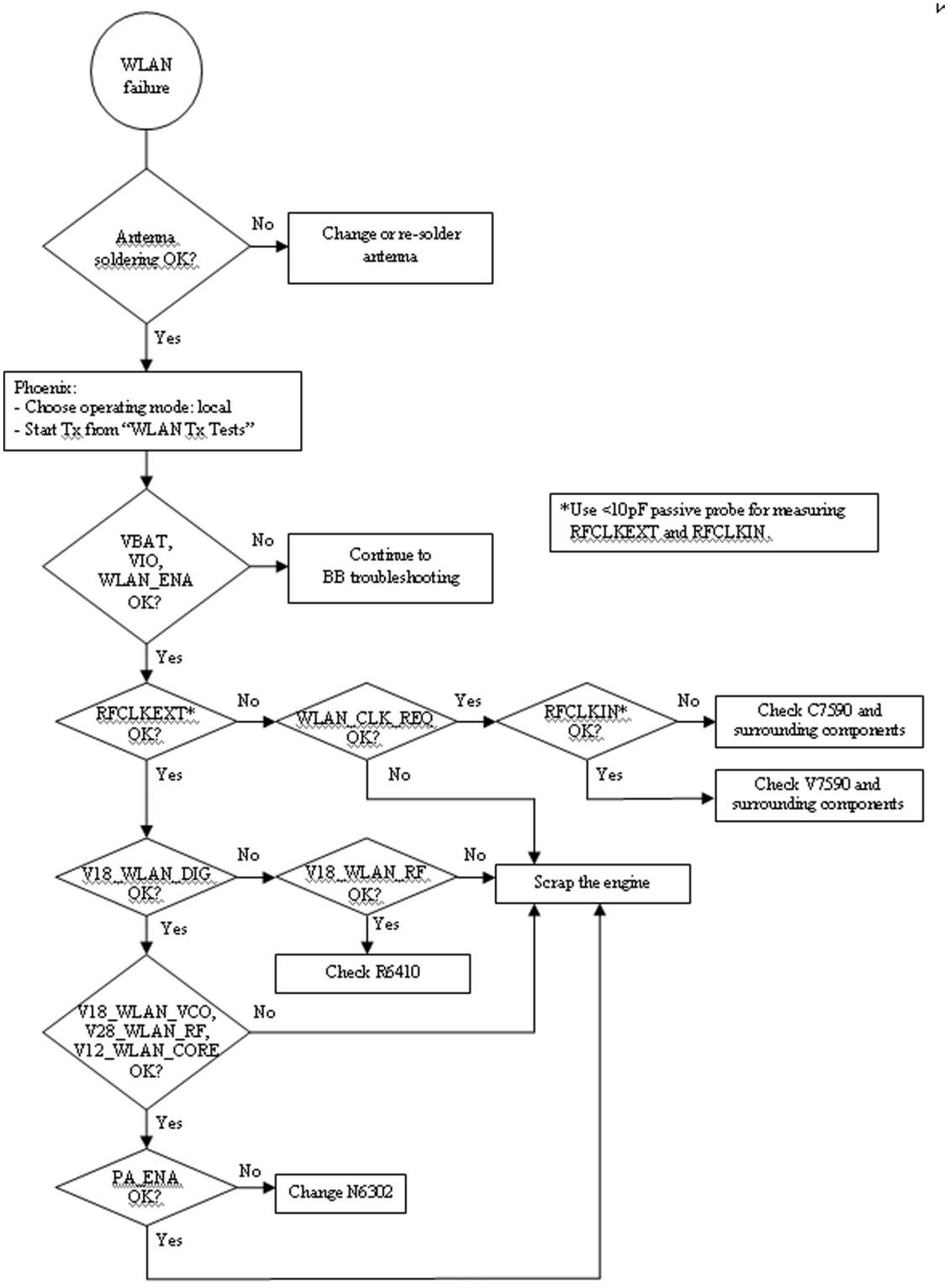
4. Turn the **Power state: On** and press **Scan**.
5. After few seconds, a list of found WLAN networks should be updated. If WLAN is working, at least a station with an SSID name **default**should be found.

## WLAN failure troubleshooting

### Troubleshooting flow





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# 8 — System Module


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# Baseband description

## System module block diagram

RM-178/RM-106 Transceivers of two Blocks, Upper Block and Lower Block. Upper Block consists of Upper PWB Module. Lower block consists of Engine (BB/RF) PWB Module.

The Upper block is connected to the Lower Block (BB/RF module) via a 50-pin connector and coaxial cables (43- cables).

Most of the BB parts (also RF and BT) are on the topside of the Engine Module. FM parts, external audio small components, hall sensor, upper block connector and keyboard are on the backside of the Engine Module. Accessories and charger can be connected via the Pop-Port™ connector and the charger connector at the bottom of the phone.

Upper PWB Module consists of two Displays, Earpiece, IHF, Camera, HWA, two DC/DC converters and one regulator and connector to Engine Module.

> **Note:** In this description, user interface HW (UI HW) covers display, camera, keyboard and keyboard backlight.


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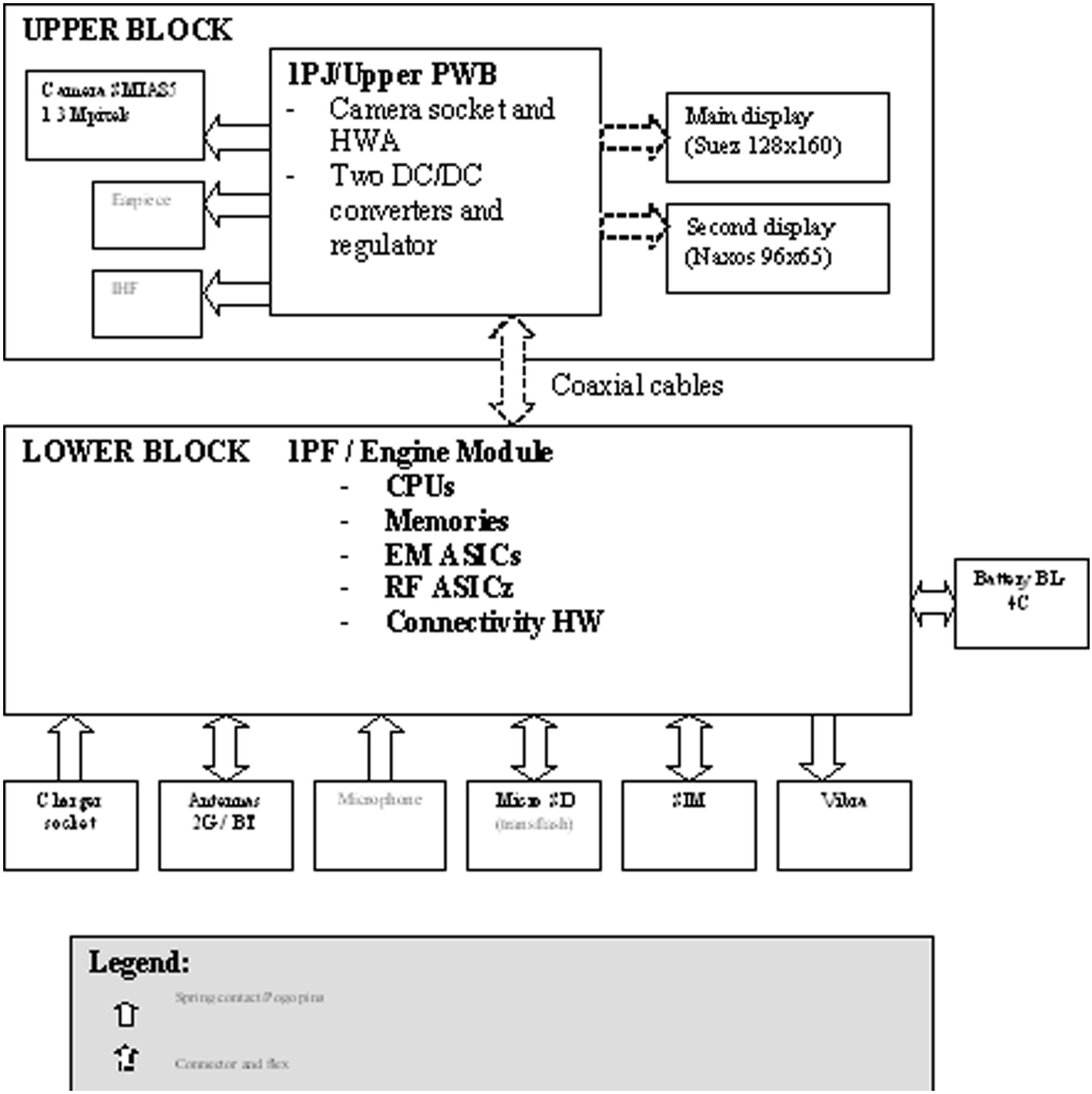


**Figure 57 System level block diagram**

## Baseband functional description

Digital baseband consists of ISA based modem and application sections. Modem functionality is in RAPGSM ASIC.

The modem section consists of RAPGSM ASIC and NOR Flash and DRAM memory as the core. NOR Flash and DRAM memories are in one package (Combo) RAPGSM supports cellular protocols of GSM (minimum EDGE glass 10, GPRS phase2). Modem DRAM memory has 128Mbits of memory and NOR flash has 256Mbits of memory. RAPGSM operates with the system clock of 38.4 MHz, which comes from the VCTCXO.


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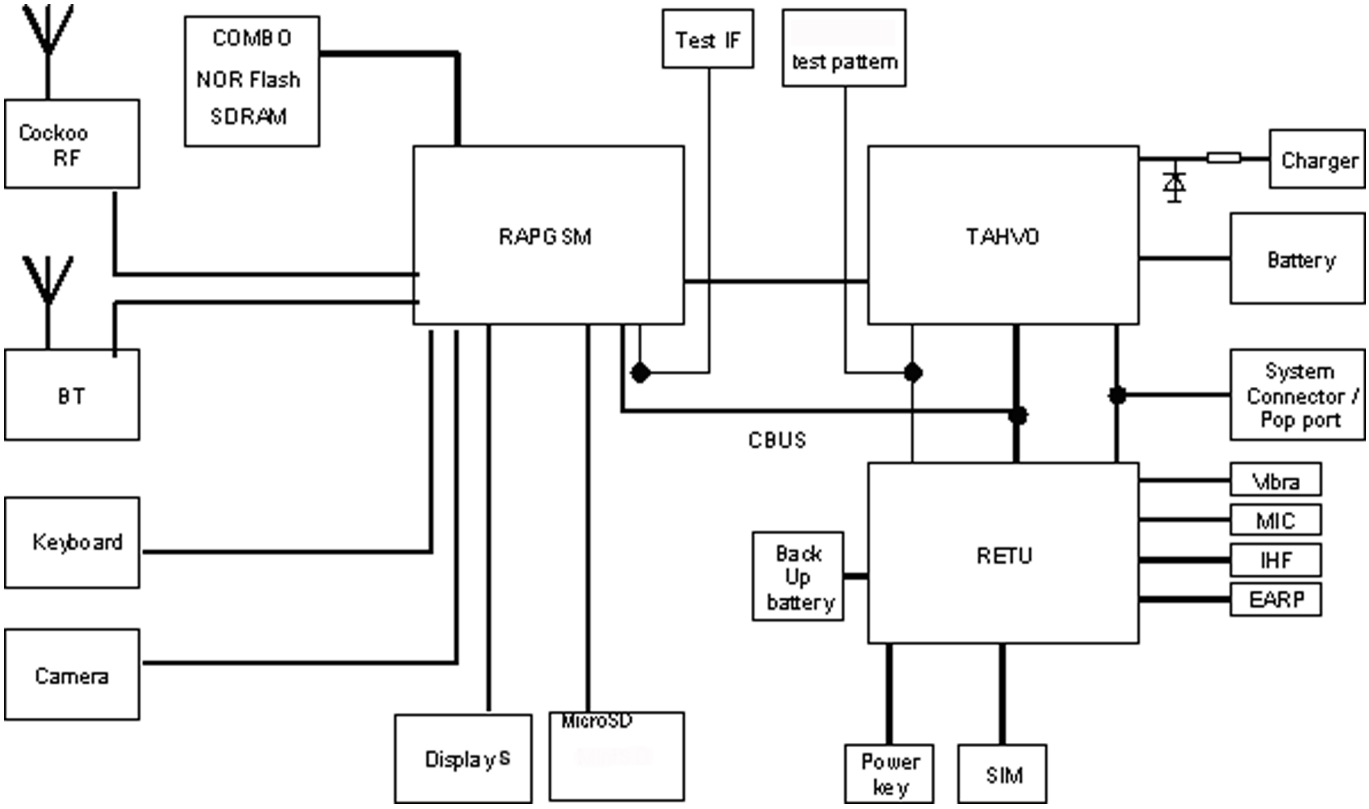


**Figure 58 RM-178 Functional block diagram**

## Absolute maximum ratings

| Signal | Min | Nom | Max | Unit | Notes |
|---|---|---|---|---|---|
| Battery voltage (idle) | -0.3 | | +4.5 | V | Battery voltage maximum value is specified during charging is active |
| Battery voltage (Call) | | | +4.3 | V | Battery voltage maximum value is specified during charging is active |
| Charger input voltage | -0.3 | | +16V | V | |
| Back-Up supply voltage | 0 | 2.5 | 2.7 | V | Maximum capacity of the backup power supply assumed to be 4 µAh. |

## Phone modes of operation

| Mode | Description |
|---|---|
| NO_SUPPLY | (dead) mode means that the main battery is not present or its voltage is too low (below EM ASIC (N2200) master reset threshold) and that the back-up battery voltage is too low. |
| BACK_UP | The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32kHz oscillator is running (RTC is on). |


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| Mode | Description |
|---|---|
| PWR_OFF | In this mode (warm), the main battery is present and its voltage is over EM ASIC (N2200) master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off. |
| RESET | RESET mode is a synonym for start-up sequence. RESET mode uses 32kHz clock to count the REST mode delay (typically 16ms). |
| SLEEP | SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low. |
| FLASHING | FLASHING mode is for SW downloading. |

## Voltage limits

| Parameter | Description | Value |
|---|---|---|
| VMSTR | Master reset threshold (EM ASIC N2200) | 2.2V (typ.) |
| VMSTR+ | Threshold for charging, rising (EM ASIC N2300) | 2.1V (typ.) |
| VMSTR- | Threshold for charging, falling (EM ASIC N2300) | 1.9V (typ.) |
| VCOFF+ | Hardware cutoff (rising) | 2.9V (typ.) |
| VCOFF- | Hardware cutoff (falling) | 2.6V (typ.) |
| SWCOFF | SW cutoff limit | ~3.2V |

## Power key

The system boots up when power key is pressed (adequate battery voltage, VBAT, present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). Power on key is connected to EM ASIC (N2200) ASIC via PWRONX signal.


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## Power distribution

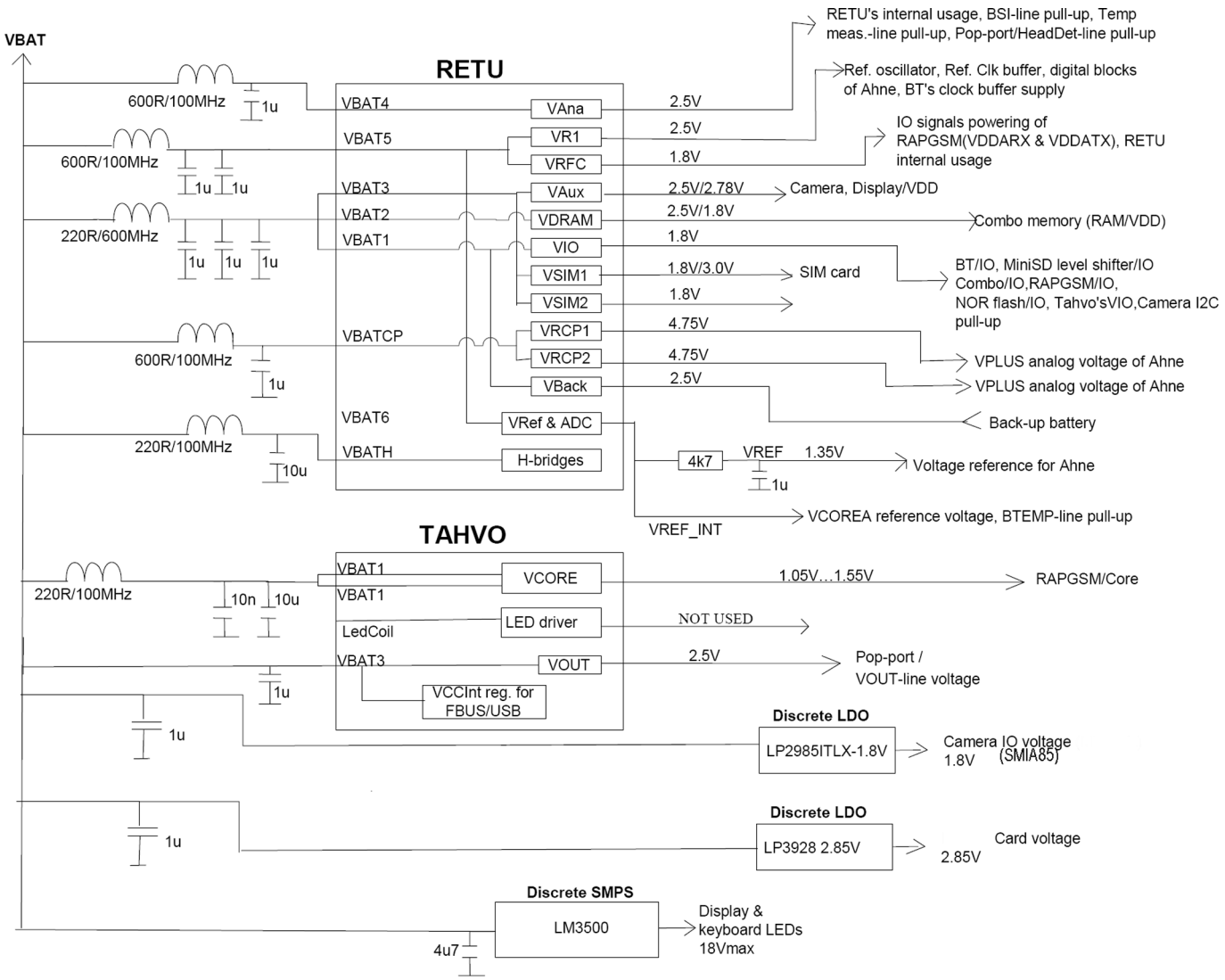


**Figure 59 Power distribution diagram**

Power supply components:

- RETU
- TAHVO
- BT LDO
- camera LDO and DC/DC converter
- MicroSD LDO
- camera flash
- backlight SMPSs

All the above are powered by the main battery voltage.

Battery voltage is also used on the RF side for power amplifiers (GSM PA) and for RF ASIC Ahne.

Discrete power supplies are used to generate 1.8V for the camera module, 2.85V for MicroSD card and max. 18V for backlight LEDs.

The device supports both 1.8V/3V SIM cards which are powered by RETU / VSIM1. RETUs VSIM2 is not used. USB accessories which needs power from the device are powered by TAHVO / VOUT.


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## System power-up

After inserting the main battery, regulators started by HW are enabled. SW checks, if there is some reason to keep the power on. If not, the system is set to power off state by watchdog. Power up can be caused by the following reasons:

- Power key is pressed
- Charger is connected
- RTC alarm occurs
- MBUS wake-up

### Clocking scheme

In BB5.0, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768kHz sleep clock produced by EM ASIC (N2200) with an external crystal.

RF clock is used by RAP that then provides (divided) 19.2MHz SysClk further to the application processor. RAP has internal PLLs which then create clock signals for other peripheral devices/interfaces like SD card, SIM, CCP, I2C and memories.

**32k Sleep Clock** is always powered on after startup. Sleep clock is used by RAP.

**SMPS Clk** is 2.4MHz clock line from RAP to EM ASIC (N2300) used for switch mode regulator synchronizing in active mode.

**BT Clk** is 38.4MHz signal from Ahne ASIC to BT module.

### RM-178 Bluetooth

Bluetooth provides a fully digital link for communication between a master unit and one or more slave units. The system provides a radio link that offers a high degree of flexibility to support various applications and product scenarios. Data and control interface for a low power RF module is provided. Data rate is regulated between the master and the slave.

The device Bluetooth is based on BC4 ROM1.0RDL BT chip.

### USB

USB (Universal Serial Bus) provides a wired connectivity between host PC and peripheral devices.

USB is a differential serial bus for USB devices. USB controller (RAP) supports USB specification revision 2.0 with full speed USB (12 Mbps). The device is connected to the USB host through the system connector. The USB bus is hot plugged capable, which means that USB devices may be plugged in/out at any time.

### RM-106/199 WLAN

The STMicroelectronics STLC4370 is a fully integrated wireless radio including a zero IF transceiver, RF Synthesizer/VCO, high-speed data converters, an OFDM/CCK digital baseband processor, an ARM9-based MAC and a complete Power Management Unit. In the power management unit switching stepdown regulator generates the MAC/BB digital core supply at 1.2 V. Two separate LDOs at 1.8 V output supply the VCO and the transceiver. The main 1.8 V supply is used for transceiver analog parts, ADC/DAC and digital circuits inside the transceiver.

RFMD RF5924 Front-End Module (FEM) is a single integrated module. The FEM has integrated b/g power amplifier, power detector, RX balun and TX filtering.


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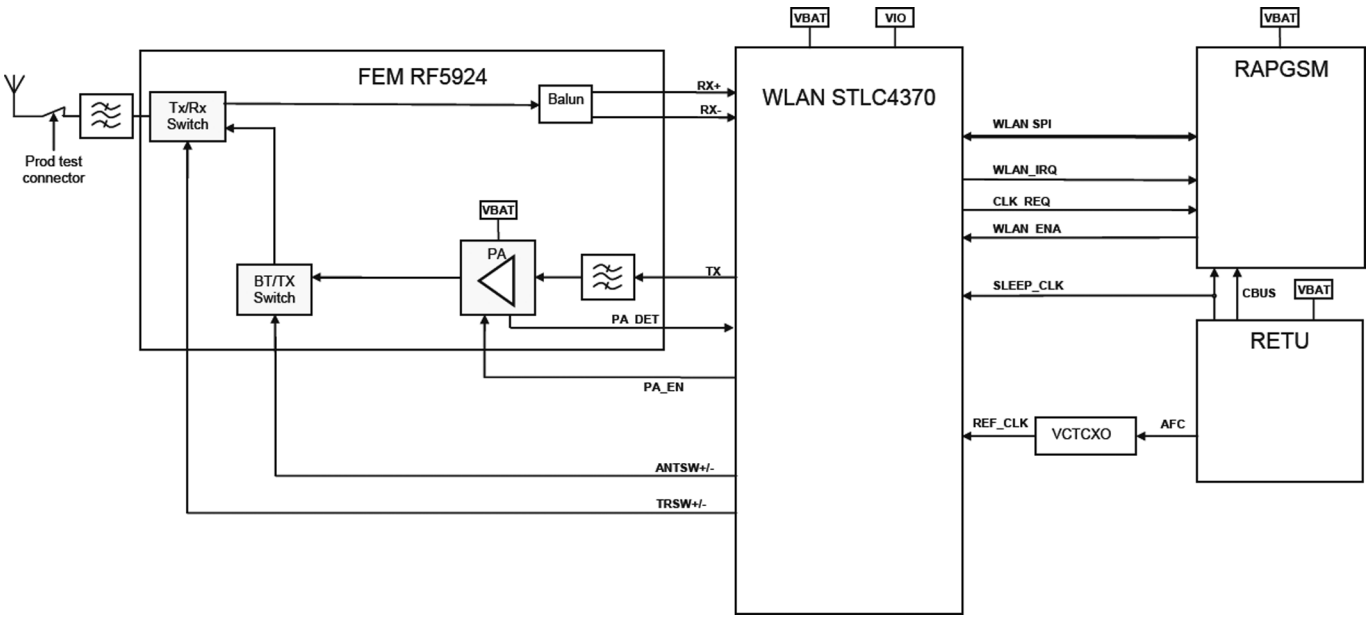


**Figure 60 RM-106/199 WLAN block description**

## Hall sensor

HALL sensor is used to monitor the position of the upper block in slide construction.

The function of a Hall sensor is based on the physical principle of the Hall effect. Hall voltage is generated over sensor when magnetic field traverses the sensor.

There is an integrated comparator and switches in Hall switches. When sensor is in magnetic field, switch is closed and output is connected to GND.

Hall sensor detects the slide position. There is a magnet in slide mechanics under the display module and when the slide is closed Hall sensor is in magnetic field.

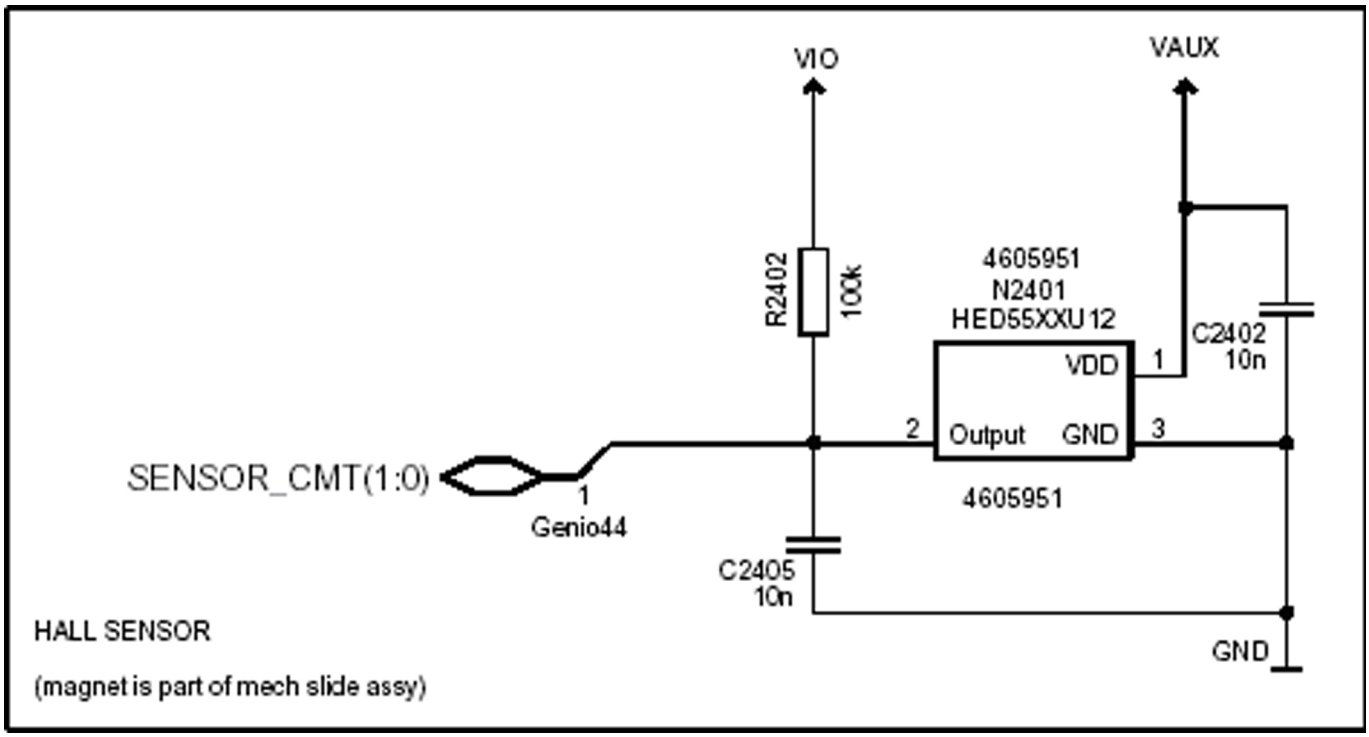


**Figure 61 Hall sensor connection**


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## FM radio

The FM radio circuitry is implemented using a highly integrated radio TEA5761UK. The MCU SW controls the FM radio circuitry through I2C interface.

The analogue single ended stereo output, VAFL and VAFL, are fed to the Retu's MIC3 microphone input through 100nF capacitors.

The antenna of the FM Radio is created with the headset. The wires of the headset are used as poles of the antenna.

## Camera

The device uses SMIA85 camera module. SMIA85 is 1.3Mpixel camera with sensor resolution of 1280 x 1024. There is also HWA (hardware accelerator) STV0984 which is between RAPGSM and camera. This receives the data from CCP bus and packs the data more and sends to the RAPGSM.

Bi-directional control bus is SW implemented I2C interface. External camera DC/DC converter (VIO level 1.8V, VCAMDIG) N1470 powers digital parts of the camera. External regulator (VANA_EXT 2.8V) N1480 powers analog parts of camera.

## IrDA

The device supports data connectivity via the Infra Red link. The IR interface is implemented using GENIO port of RAPGSM.

Main external component is the IR module. The data rate supported will be 1.152Mbit. The maximum operating distance of IrDA is approximately 1 meter.

## Test pattern

# Test pattern

Test pattern is placed on the transceiver PWB on the battery side for service and programming and test purposes

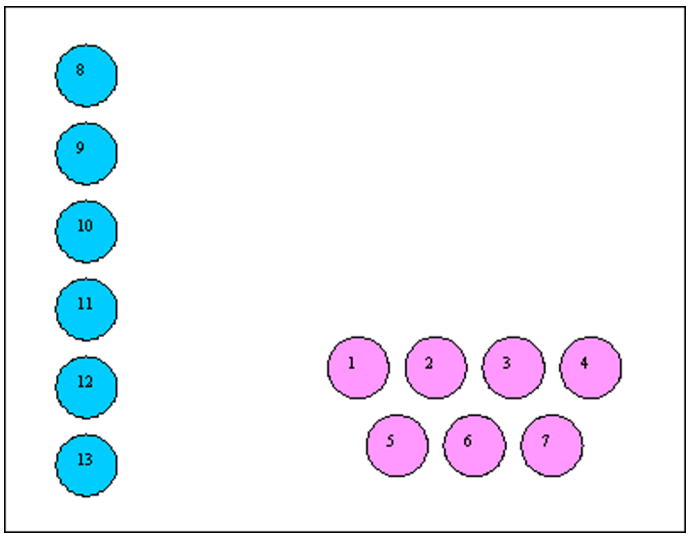


**Figure 62 Test pattern**

## Backup battery

When the main battery is not attached EM ASIC (N2200) goes in backup mode using back-up battery that supplies voltage to RTC in EM ASIC (N2200).


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### CBUS interface

CBUS is a "main" system control bus in BB5.0. RAP controls the functionality of EM ASIC (N2200) and EM ASIC (N2300) ASICs with CBUS.

CBUS is a four-wire half-duplex master-slave interface. In BB5.0 CBUS clock frequency is 2.4 MHz.

### FBUS

USB and FBUS have multiplexed interface between EM ASIC (2300) and RAP.

### ACI interface

The ACI (Accessory Control Interface) is a point-to-point, bi-directional, single line serial bus.

It has two main features: the insertion and removal detection of an accessory device and acting as a data bus between phone and accessory, intended for control purposes. A third function of ACI is to identify and authenticate the accessory.

### VOUT interface

Accessory power is supplied by VOUT, a linear low drop-out regulator in EM ASIC (N2300) providing 2.5V at 90mA maximum when active (0.5mA in sleep).

ACI data passes to and from EM ASIC (N2300) via the HeadDet line. EM ASIC (N2300) connects HeadDet to MBUS for RAP to access.

### Charger interface

Charging control and charge switch are situated in EM ASIC (N2300).

If the temperature rises too high and the thermal protection is activated, EM ASIC (N2300) goes to protection mode.

### MicroSD interface

## MicroSD interface

The MicroSD card interface is electrically and functionally compatible with SD card interface. SD card interface is a 1-bit serial IF connected to RAPGSM.

### SIM/USIM

The device has one SIM (Subscriber Identification Module) interface and the SIM card locates under the battery.

SIM interface consists of internal interface between RAP and EM ASIC (N2200) and an external interface between Retu and SIM contacts.

SIM interface functionality is located in RAP while EM ASIC (N2200) takes care of power up/down, card detection, ATR counting and level shifting. EM ASIC (N2200) external SIM IF connections and electrical characteristics between ASICs are shown in the picture.


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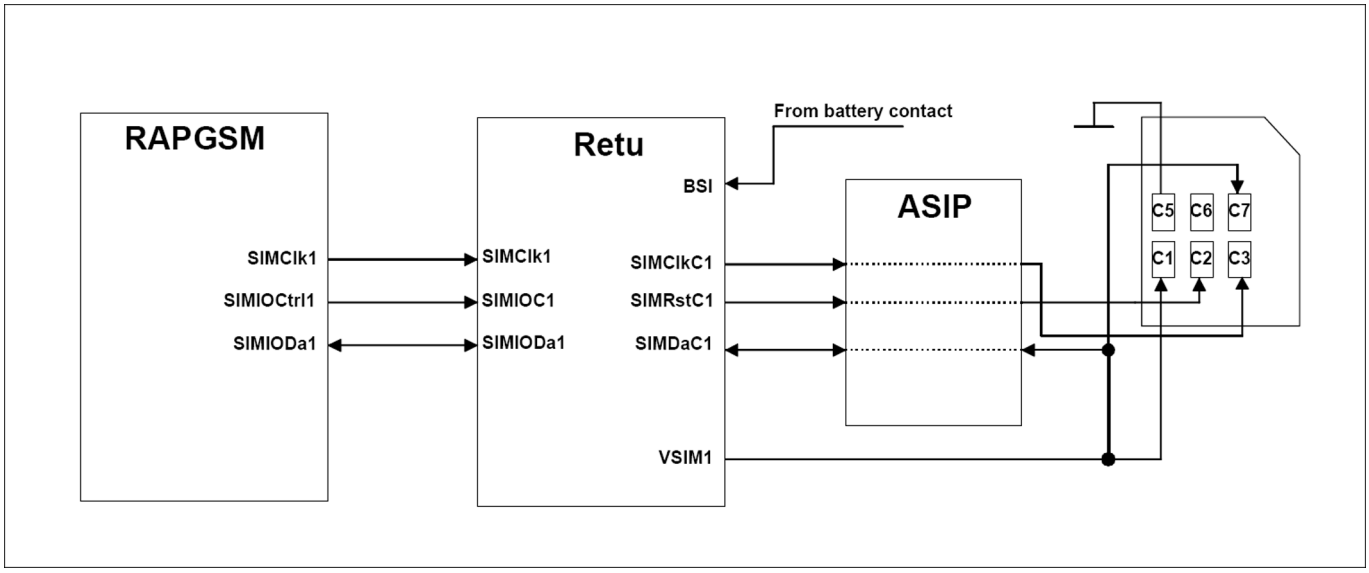


EM ASIC (N2200) handles SIM card detection and the detection method is based on battery removal trough the BSI line.

Due to location of the SIM card, removal of the battery causes quick power down of the SIM IF. The EM ASIC (N2200) SIM1 interface supports both the 1.8V and 3.0V SIM cards.

SIM interface voltage is first 1.8V when the SIM card is inserted and if the card does not response to the ATR (answer to reset) 3V interface voltage is used.

## Battery interface

The battery interface supports a 3-pole battery interface. The interface consists of three connectors: VBAT, BSI and GND.

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

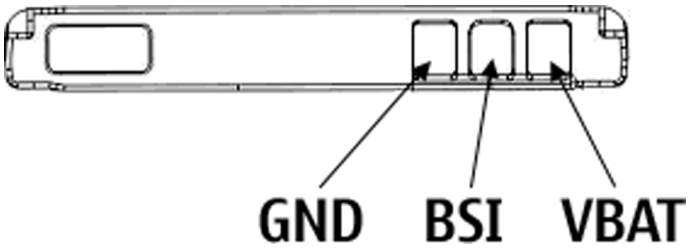


**Figure 63 Battery pin order**

**Table 15 Battery interface connections**

| Pin | Signal | I/O | Engine connection | | Notes |
|---|---|---|---|---|---|
| 1 | VBAT | -> | EM ASIC N2200 | VBAT | Battery voltage |
| 2 | BSI | -> | EM ASIC N2200 | BSI | Battery size indication (fixed resistor inside the battery pack) |
| 3 | GND | | GND | | Ground |


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Battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line, which is located on the transceiver PWB, at a place where the phone temperature is most stable.

For service purposes, the device SW can be forced into local mode by using pull down resistors connected to the BSI line.

## User interface

### *Display interface*

### Display module mechanical concept

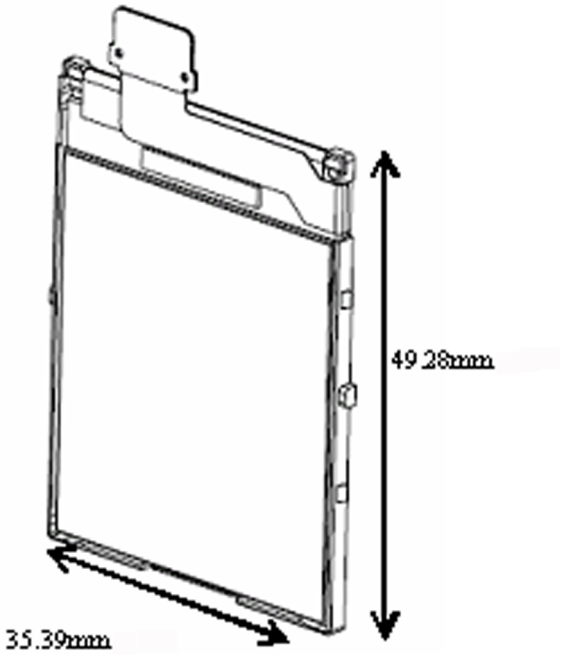


**Figure 64 LCD module**

Display features:

- QVGA resolution, 132x162
- Active area is 28.91mmx35.48mm, 1.8”
- Partial display function Power saving by pausing display process on part of the screen.
- Built-in RAM capacity 132rows×162lines×18bit


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## *Cover UI display*

### Display module mechanical concept

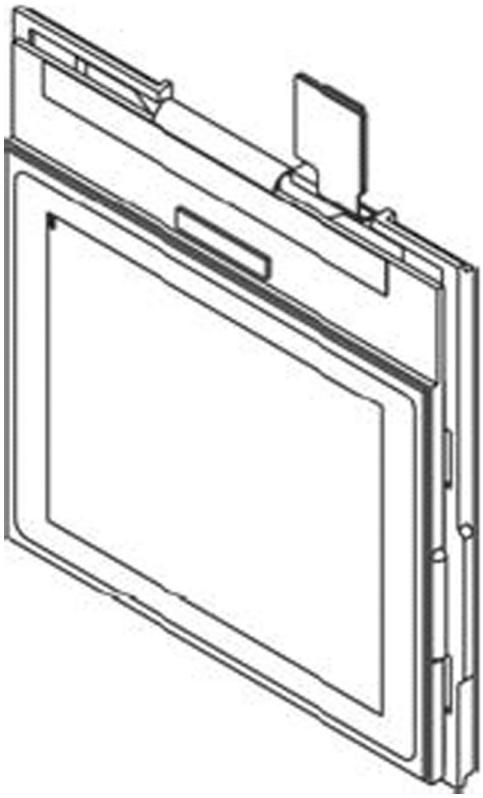

**Figure 65 General diagram of the LCD module**

Display features:

- Module size (width x height x thickness): 37.00 mm • 36.90 mm • 3.0 mm
- Resolution 98 x 70 pixel
- Numbers of colours up to 65k
- Partial display function; power saving by pausing display process on part of the screen
- Built-in RAM capacity 98 columns x 70 rows x 16bits = 109,760 bits

The display has two different operating modes:

- Normal mode, Full screen, 65k colors
- Normal partial mode, 8 colors but only part of the display is active

The display module does not require any tunings in service.

## *Keyboard*

The device keyboard consists of 24 separate keys.

The keyboard is implemented as a matrix keyboard, which is connected directly to the dedicated keyboard GENIO lines, except the power on key, which is connected to RETU..

The keymatrix has six rows and four columns.


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### *Backlights*

## Backlights

The main display has three white LEDs and the secondary display has two white LEDs for display backlight inside of the display module. Voltage source for backlights is implemented using an external white LED driver on upper block.

There is NPN digital transistor which controls which display is lighted at the time. The transistor is controlled by GENIO03. There is no possibility to turn both display backlights on in the same time.

The driver increases battery voltage up to 18V. Driver is enabled by Tahvo's PWM300 output. PWM300 is SW controlled pulse width modulated (PWM) output.

There are four LEDs in series for keyboard backlight. There is own driver for keyboard backlight which can increases battery voltage up to 18V.

Both displays and keyboard backlight current is monitored using LED drivers' feedback input.

## ASICs

### *RAP ASIC*

RAP is a GSM EDGE chip (modem ASIC) with lots of peripheral features.

The subsystems are combined at the glue level;

- processor subsystem (PSS) that includes ARM926 MCU as a main processor
- Lead3 PH3 DSP and related functions
- ASIC clock and reset control
- MCU peripherals e.g. CBUS IF, USB IF and SIM IF
- DSP peripherals e.g. speech codec
- Clock slicer. It is a block that gets low amplitude differential sinusoidal clock wave RfClkP & RfClkN 38.4MHz) in and gives an accurate square wave out (SYSCLK 19.2MHz).
- RF Codec that includes ADC and DAC converters for the RF signal

### *EM ASIC (N2200)*

EM ASIC (N2200) includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768 kHz clock with external crystal
- Real time clock with external backup battery
- SIM card interface
- Stereo audio codecs and amplifiers
- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)


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### *EM ASIC (N2300)*

EM ASIC (N2300) is intended for energy management control, supply voltage generation and charge control of mobile phone.

## Device memories

### *RAPGSM memories NOR flash and SDRAM*

Modem memory consists of 128Mbit SDRAM and 256 Mbit NOR flash memory.

SDRAM is dynamic memory for ISA SW. NOR is used for ISA SW code and PMM data and CDSP SW code.

# Audio concept

## Audio HW architecture

The functional core of the audio hardware is built around two ASICs: RAPGSM engine ASIC and the mixed-signal ASIC Retu.

Retu provides an interface for the transducers and the accessory connector.

There are three audio transducers:

- 7x11 mm dynamic earpiece
- one 11x15 mm dynamic speaker
- electret microphone module


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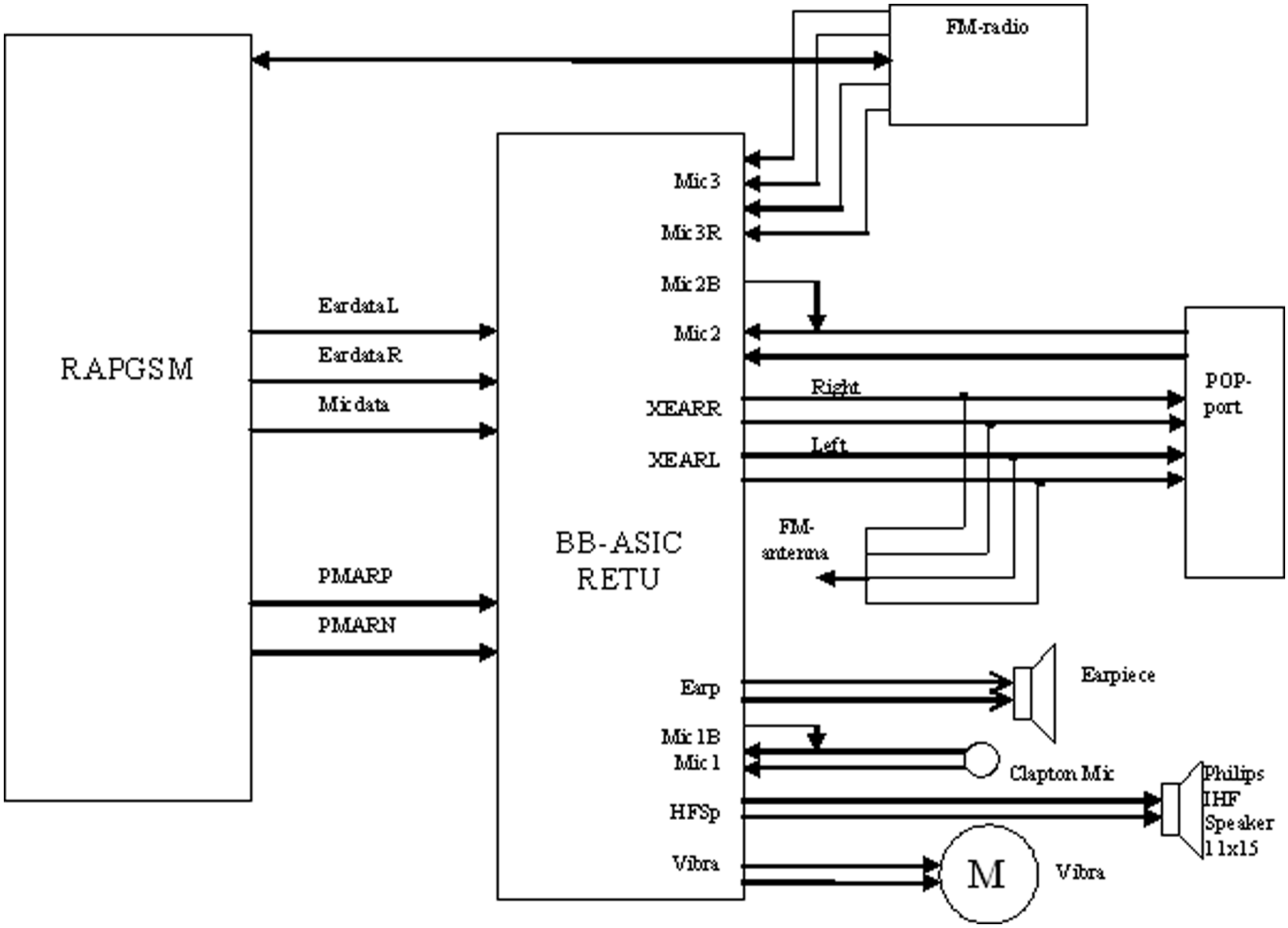


**Figure 66 Audio block diagram**

## Internal microphone

Internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes.

An analogue electret microphone is connected to N2200 Mic1P and Mic1N inputs via asymmetric electrical connection.

The microphone is biased by N2200 MicB1 bias voltage output.

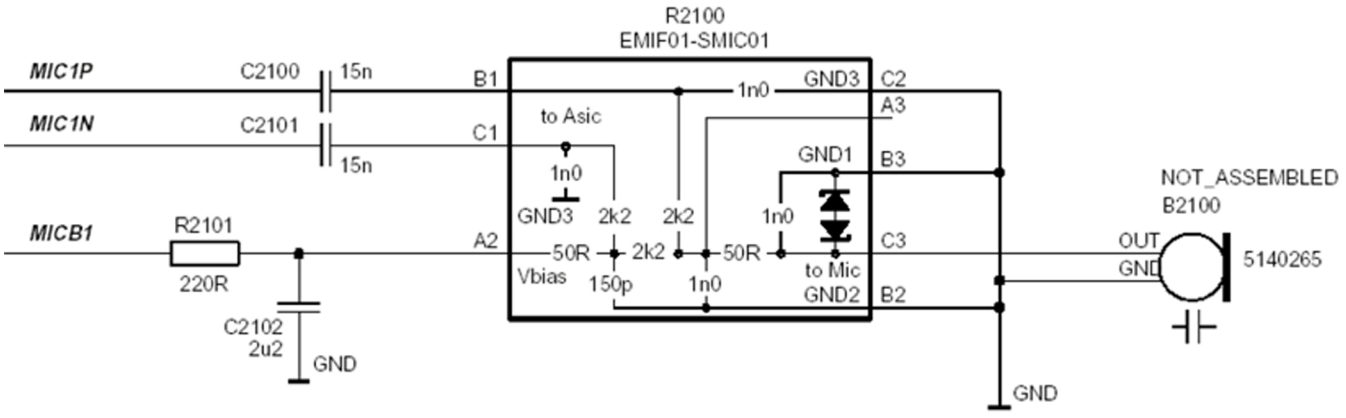


**Figure 67 Internal microphone circuitry**


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## External microphone

Galvanic accessories are connected to the system connector.

The accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

External microphone circuitry is biased by N2200 MicB2 bias voltage output. The circuitry provides a symmetrical connection for the microphone from the system connector connections, XMICN and XMICP, to N2200 inputs, Mic2P and Mic2N.

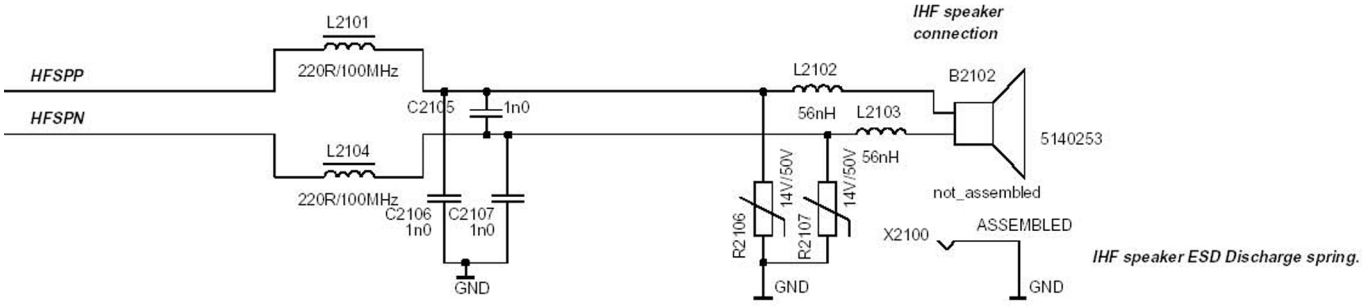


**Figure 68 External microphone circuitry (Pop-Port™ connects to the right side)**

## Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. A dynamic 8mm earpiece capsule is connected to EM ASIC's (N2200) differential output EarP and EarN.

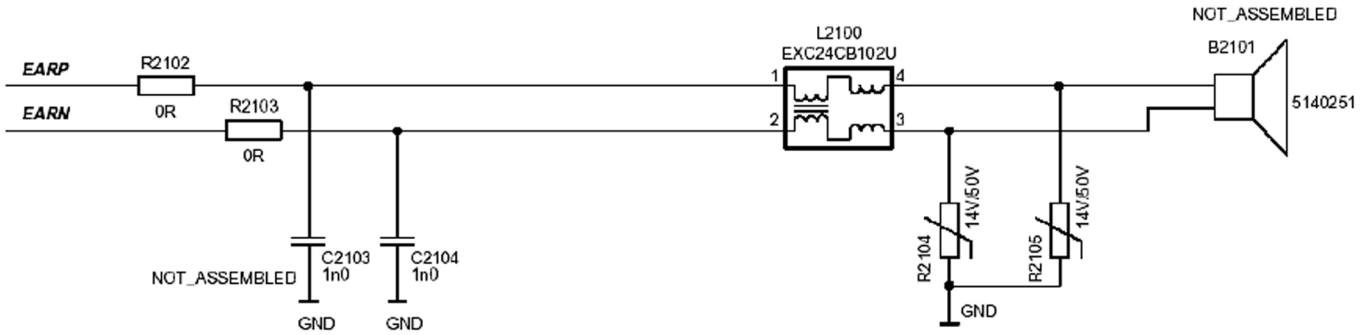


**Figure 69 Internal earpiece circuitry**

## Internal speakers

Internal speakers are used for Internal HandsFree (IHF) call mode, ringing tones, FM-radio and music listening.

The dynamic 11x15mm speaker is connected to Retu ASIC's outputs HFSp P/N.

There is an audio power amplifier (H-bridge) inside Retu.


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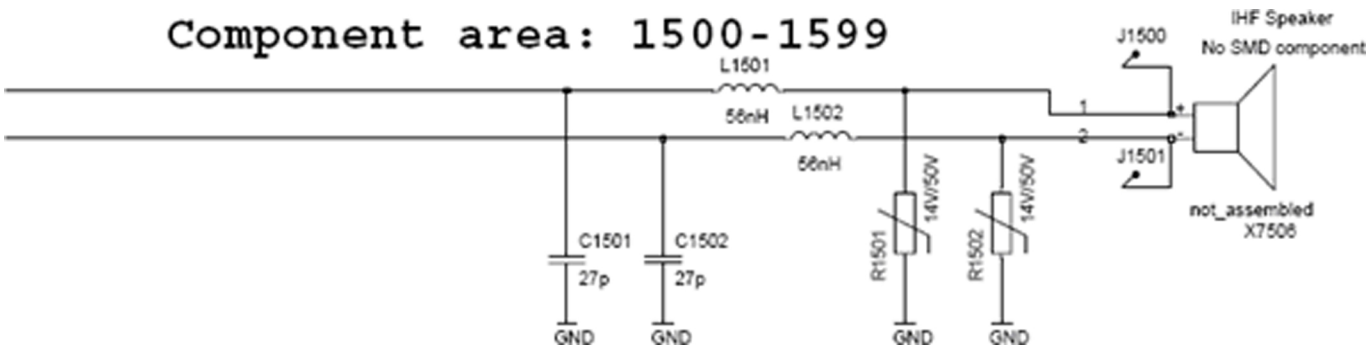


**Figure 70 Internal speaker circuitry**

## External earpiece

All galvanic accessories are connected to the system connector (Pop-Port™).

The accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

Retu ASIC provides two output channels in either single-ended or differential format. Retu ASIC outputs XearL and XearLC form the left channel audio output, and XearR and XearRC the right channel audio output. XearLC and XearRC are the ground pins if the output works in a single-ended operation.

Xear lines have 10 Ω series resistors in each line.

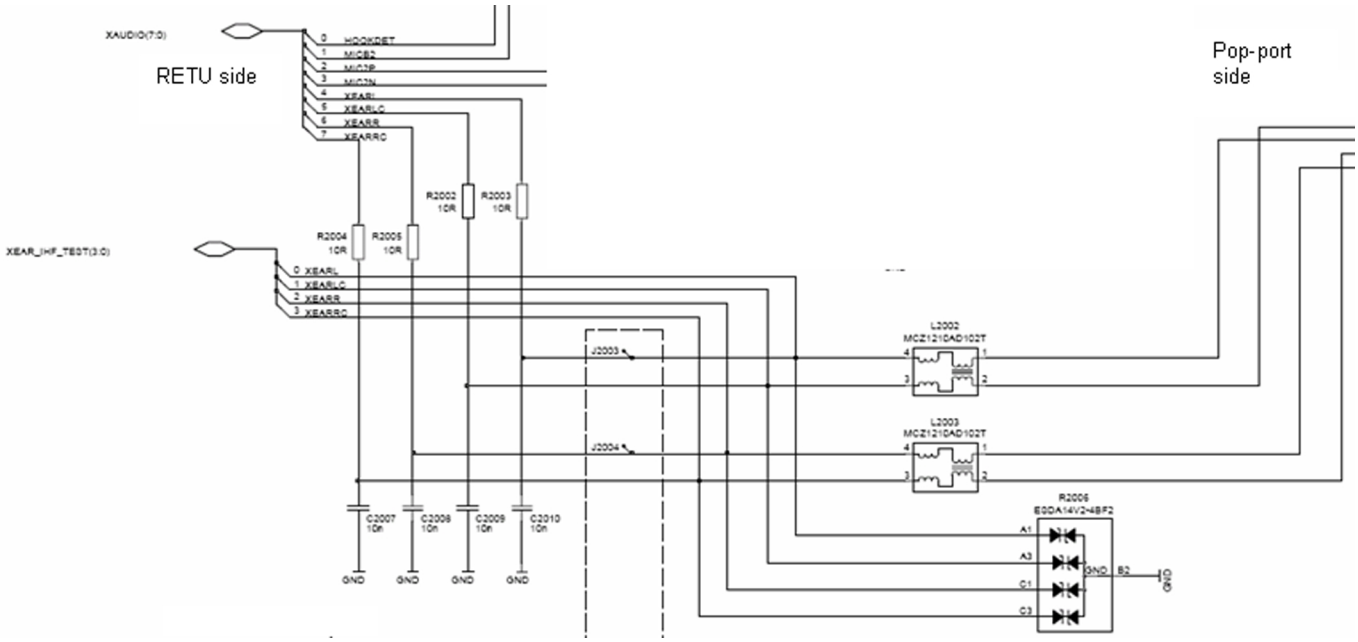


**Figure 71 External earpiece circuitry (Pop-Port™ connected on the right)**

## Vibra circuitry

Vibra is used for vibra-alarm function.

A vibra lifter is used to connect the vibra to the main PWB because of mechanically structure. The vibra underlay is a simple PWB piece.


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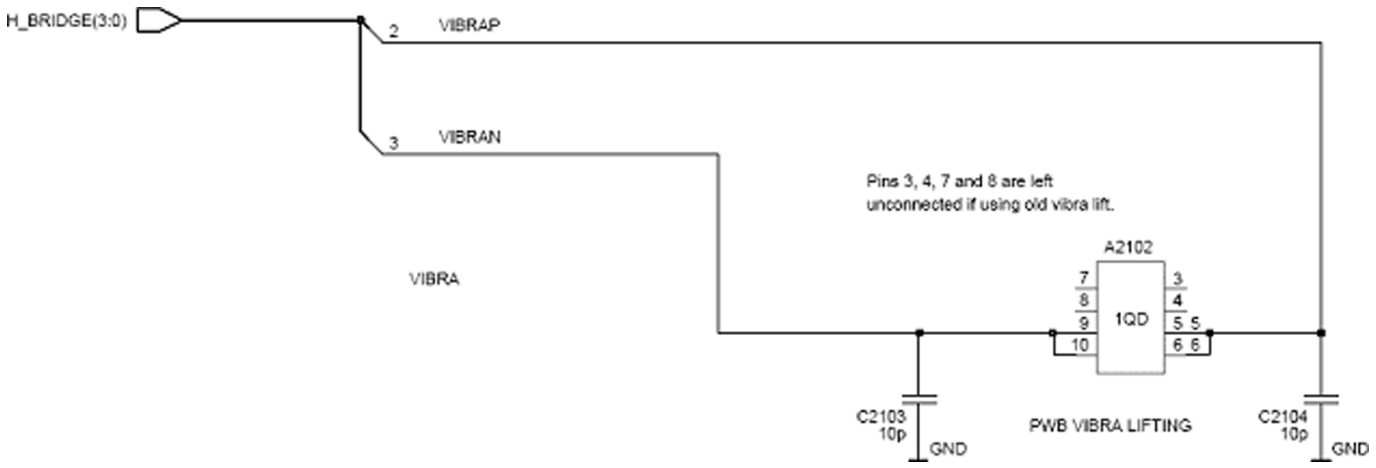


**Figure 72 Vibra circuitry**

## Baseband technical specifications

### External interfaces

| Name of Connection | Connector reference |
|---|---|
| USB | X2000 |
| Charger | X2002 and X2000 |
| SIM | X2701 |
| MicroSD | X3200 |
| Battery connector | X2070 |
| SIM | X2701 |

### Pop-port™ connector

Pop-Port™ connector provides a fully differential 4–wire stereo line-level output connection and fully differential 2-wire mono line-level or microphone level input connection.

The handsfree driver in Retu is meant for the headset.

The output is driven in a fully differential mode. In the fully differential mode, the handsfree pin is the negative output and the HFCM pin is the positive output. The gain of the handsfree driver in the differential mode is 6 dB.

The earpiece and headset signals are multiplexed so that the outputs cannot be used simultaneously.


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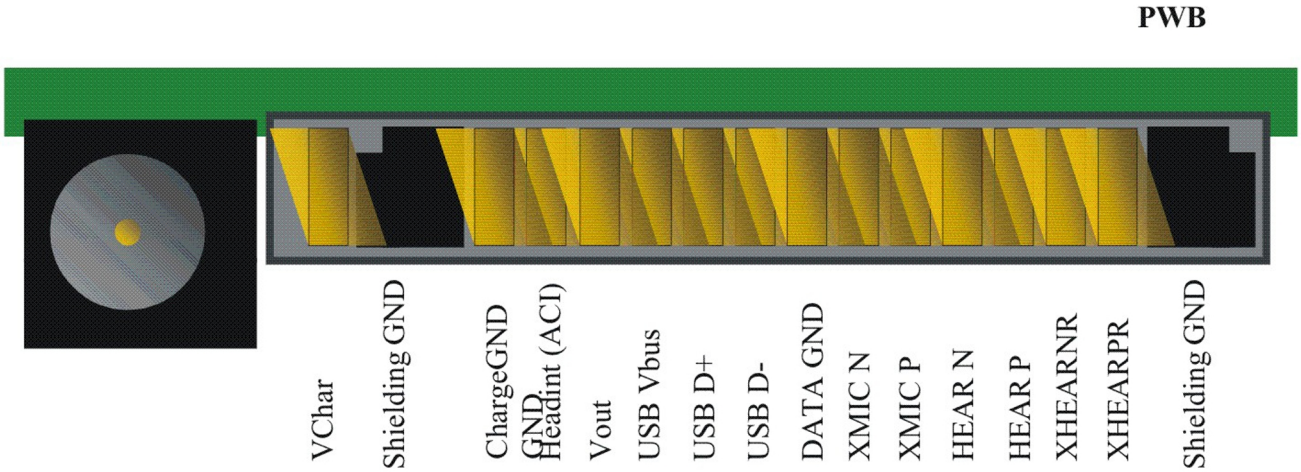


**Figure 73 External audio connector**

**Table 16 Audio connector pin assignments**

| Pin #/ Signal name | Signal description | Spectral range | Voltage/ Current levels | Max or nominal serial impedance | Notes |
|---|---|---|---|---|---|
| 1/ Charge | V Charge | DC | 0-9V/ 0.85A | | |
| 2/ GND | Charge GND | - | 0.85A | 100mΩ (PWB+ conn.) | |
| 3/ ACI | ACI | 1kbits/s | Digital 0 / 2.5-2.78V | 47Ω | Insertion & removal detection |
| 4/ Vout | DC out | DC | 2.78V 70 mA / 2.5V 90mA | 100mΩ (PWB+ conn.) | 200mW |
| 9 / XMIC N | Audio in | 300-8k | 1Vpp & 2.5-2.78VDC | | |
| 10 / XMIC P | Audio in | 300-8k | 1Vpp & 2.5-2.78VDC | | |
| 11 / HEAR N | Audio out | 20-20k | 1Vpp | 22Ω | |
| 12 / HEAR P | Audio out | 20-20k | 1Vpp | 22Ω | |
| 13 / HEAR R N | Audio out | 20-20k | 1Vpp | 22Ω | Not conn. in mono |
| 14 / HEAR R P | Audio out | 20-20k | 1Vpp | 22Ω | Not conn. in mono |


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## VOUT electrical characteristics

| Description | Parameter | Min | Max | Typical | Unit | Notes |
|---|---|---|---|---|---|---|
| Vout regulator for external accessories | VOUT | 2.43 | 2.57 | 2.5 | V | Max load 90mA |

## CBUS connections and electrical characteristics

### CBUS connections

| Pin name | | I/O | Connection | | Notes |
|---|---|---|---|---|---|
| RAPGSM | CbusDa | <-> | Retu | Serdata | Cbus data |
| | | | Tahvo/FM-radio | CbusData | |
| RAPGSM | CbusClk | -> | Retu | SerClk | Cbus clock, 2.4 MHz |
| | | | Tahvo/FM-radio | CbusClk | |
| RAPGSM | CbusEn1X | -> | Retu | Sersel | Cbus enable |

### CBUS electrical characteristics

| Description | Parameter | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| High-level input voltage | VIH | 0.7 x VDDS | | VDDS | V | RAPGSM specific |
| (VDDS = 1.8V) | | | | | | |
| Low-level input voltage | VIL | 0 | | 0.3 x VDDS | V | |
| High-level output voltage | VOH | 0.8 x VDDS | | VDDS | V | |
| Low-level output voltage | VOL | 0 | | 0.22 x VDDS | V | |
| Frequency, CbusClk | f | 1 | 2.4 | 2.5 | MHz | |
| Rise and fall time | tR/tF | | | | | Tahvo specific |
| CLK, DaOut, EnX | | | | 6 | ns | |
| DaIn | | | | 25 | ns | |


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## USB/FBUS connections and electrical characteristics

The USB operates in the low-power bus-mode only. The USB host provides VBUS voltage (5V, 100mA at maximum) to USB device. The USB VBUS is connected to the input of the EM ASIC (N2300) USB/FBUS regulator, which output is 3.3V in USB mode.

## Audio signal electrical characteristics

| Description | Parameter | Typ | Unit | Notes |
|---|---|---|---|---|
| XMIC N | Audio in | 1 | $V_{pp}$ | DC Offset 2.5-2.78V |
| XMIC P | Audio in | 1 | $V_{pp}$ | DC Offset 2.5-2.78V |
| HSEAR N | Audio out | 1 | $V_{pp}$ | 22Ω nominal serial impedance |
| HSEAR P | Audio out | 1 | $V_{pp}$ | 22Ω nominal serial impedance |
| HSEAR R N | Audio out | 1 | $V_{pp}$ | 22Ω nominal serial impedance |
| | | | | Not connected in mono |
| HSEAR R P | Audio out | 1 | $V_{pp}$ | 22Ω nominal serial impedance |
| | | | | Not connected in mono |

## Charger connector and charging interface connections & electrical characteristics

**Table 17 Charging interface connections**

| Pin | Signal | I/O | Engine connection | | Notes |
|---|---|---|---|---|---|
| 1 | Vchar | In | EM ASIC (N2300) | VCharIn1, 2 | Charging voltage / charger detection, Center pin |
| 2 | Charge GND | | Ground | | Charger ground |

**Table 18 Charging IF electrical characteristics**

| Description | Parameter | Min | Max | Unit | Notes |
|---|---|---|---|---|---|
| Vchar | V Charge | 0 | 16 | V | Center pin |
| Vchar | I Charge | | 0.95 | A | Center pin |
| Charge GND | | | 0.85 | A | |


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| Description | Parameter | Min | Max | Unit | Notes |
|---|---|---|---|---|---|
| Threshold for charging, rising (EM ASIC (N2300)) | $V_{MSTR+}$ | 2.1 | | V | Typical value |
| Threshold for charging, falling (EM ASIC (N2300)) | $V_{MSTR-}$ | 1.9 | | V | Typical value |

## Battery connector and interface connections & electrical characteristics

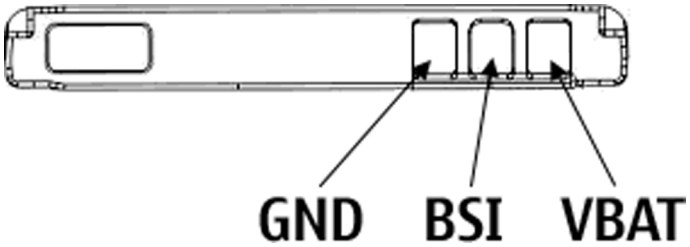


**Figure 74 Battery connector**

**Table 19 Battery interface connections**

| Pin | Signal | I/O | Engine connection | | Notes |
|---|---|---|---|---|---|
| 1 | VBAT | -> | EM ASIC N2200 | VBAT | Battery voltage |
| 2 | BSI | -> | EM ASIC N2200 | BSI | Battery size indication (fixed resistor inside the battery pack) |
| 3 | GND | | GND | | Ground |

**Table 20 Battery IF electrical characteristics**

| Description | Parameter | Max | Unit |
|---|---|---|---|
| Operation voltage | $V_{IN}$ | 4.23 | VDC |
| Current rating | $I_{IN}$ | 0.9 | A |

## Internal interfaces

| Name of Connection | Connector reference | Notes |
|---|---|---|
| UI connector | X2400<br>X1000 | Lower block<br>Upper block |
| Display Suez | X1100 | Upper block |
| Display Naxos | X1101 | Upper block |


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| Name of Connection | Connector reference | Notes |
|---|---|---|
| Camera | X1470 | Upper block (through hole socket) |
| Vibra | A2102 | Lower block |
| Microphone | B2100 | Lower block |
| Earpiece | B1200 | Upper block |
| IHF speaker | X7506 | Upper block |

## Upper block connectors

| Pin number, connector X1000 | Destination | Test point | Name of the line/signal | NOTES |
|---|---|---|---|---|
| 2 | Earpiece, B1200 | J1002 | EARN | |
| 3 | Earpiece, B1200 | J1003 | EARP | |
| 4 | IHF | J1012 | HFSPP | |
| 5 | IHF | J1013 | HFSPN | |
| 26 | Camera, X1470 | J1021 | CAMCLK | Clk 9.6MHz |
| 32 | V1103 | J1029 | LED_SWITCH | Displays backlight switch |
| 33 | Camera, X1470<br>HWA, D1470 | J1023 | CAM_ENABLE, shutdown | Camera enable |
| 35 | Main display, X1100 | J1026 | LCDTE secondary display | |
| 37 | Camera, X1470<br>HWA, D1470 | J1028 | CAM_VCTRL | Camera power enable |
| 38 | Camera, X1470<br>HWA, D1470 | J1025 | Serial CLK CCI | I2C |
| 39 | Camera, X1470<br>HWA, D1470 | J1024 | Serial Data CCI | I2C |
| 46 | LED driver, D1300 | J1011 | PWM300 | |

## Back-up battery interface connections and electrical characteristics

**Table 21 Back-up battery connections**

| Pin name | I/O | Connection | Notes |
|---|---|---|---|
| VBack | -> | N2200, VBack | Back-up battery G2200 is connected to N2200 via coil |


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**Table 22 Back-up battery electrical characteristics**

| Description | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Back-Up Battery Voltage | Vback | 0 | 2.5 | 2.7 | V |

## RF description

### Introduction to receiver functionality

Receiver functions are implemented in RF ASIC N7505.

The receiver is a linear direct conversion receiver consisting of separate front ends (LNA (Low Noise Amplifier) and demodulator) for each supported system. After the demodulators, the signal paths are combined to one common BB path.

### GSM receiver

As GSM850, GSM900, GSM1800, GSM1900 Rx branches are functionally identical, the following description is applicable to all of them.

The received signal goes from the GSM antenna to the front end module (FEM) which includes switches from band selection. FEM is followed by dedicated SAW filters which are dual packaged so that one holds SAWs for 850 and 900 and the other for 1800 and 1900 bands. The SAW filters are followed by integrated LNAs residing in N7505.

The LNAs are followed by demodulators which downconvert the signal to baseband I and Q signals.

The channel select filter is set to 115 kHz in the GSM mode.

During a DC1 operation, a sample of the DC level of the signal is stored in off chip capacitors. During reception, information is in turn used for subtracting the DC information from the input signal of the AGC (Automatic Gain Control) amplifier.

A DCN0 operation is carried out to discharge any charge from the capacitors before DCN1.

### Introduction to transmitter functionality

Transmitter functions are implemented in the RF ASIC N7505. The ASIC contains a BB frequency low pass filter, which is tunable according to the signal bandwidth of the system in use.

In addition, the N7505 contains separate RF paths comprising a final frequency IQ modulator and VGA amplifiers.

### GSM transmitter

N7505 receives an analogue IQ modulated signal from digital BB, which is first low pass filtered with filter corner frequency set to approximately 200 kHz. After the filter, the signal is routed to the GSM modulator. The amplifier gives 40 dB of power control dynamic range.

The appropriate routing after the modulator is selected by biasing either EGSM900 (/GSM850) or GSM1800/1900 variable gain amplifier. The amplifier gives 40 dB of power control dynamic range.

After the VGA stage the signal exits N7505. In case of GSM1800/1900 the signal goes directly to the FEM thru a balun, which converts single ended signal into balanced signal needed to feed the FEM. In case of GSM850 and EGSM900 the PA module is preceded by a SAW filter.

TX SAW Z7503 is also dual packaged so that the correct band is selected with control voltage coming from N7505. SAW also performs the unbalanced to balanced signal transformation. After the filter, the signal is fed to FEM. Finally the signal is routed to the antenna.


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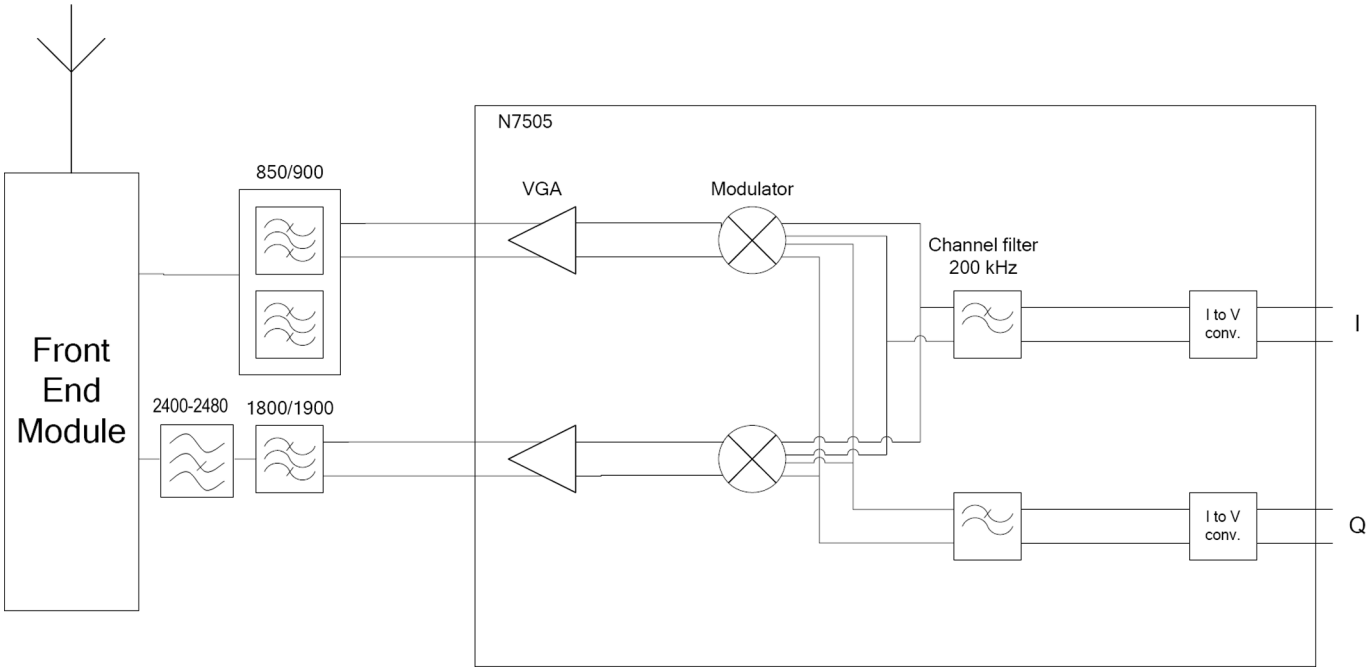


**Figure 75 GSM transmitter**

## GSM power control

A closed control loop comprise an integrated power detector (in FEM) and an error amplifier. The error amplifier resides in N7505 and it controls the transmitter power of GSM.

Detector output from the FEM gives a DC level proportional to the output power. The DC voltage is fed to the negative input of the error amplifier where it is compared to the level of the reference signal, TXC. TXC is received from the BB circuitry.

The output of the error amplifier is fed to a buffer amplifier which in turn steers the VGA amplifier.

FEM is switched on and off by changing the bias currents. As a result the output power ramping and final power level of the transmitter are set in a controlled manner. During EDGE operation 8-PSK modulation is utilised.

The bias currents are also adjusted. The power control loop is opened during the data transmission in both GSMK and EDGE modes.

The loop is opened with a dedicated TXA-signal via RFBus. When the power is ramped up, a modulating bit sequence producing a constant envelope waveform is used and the power control loop is closed. Once the desired power level has been reached, the loop is opened and the power control voltage is kept constant.

When the active part of the burst is over the loop is again closed and the power is ramped down.

The power control loop is enabled and disabled in N7505 RF ASIC. In case of dual slot transmission the output power is ramped down between the consecutive slots.

### GSM FEM (front end module)

A single GSM/EDGE FEM contains two separate amplifier chains, one for EGSM900 and GSM850 and another for GSM1800/1900.

Both amplifiers have a battery supply connection and two bias current inputs.

The bias current for final amplifier stage is adjusted according the power level in use. The bias currents are also used as on/off switching signals for PAs.


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### Frequency synthesizers

RF ASIC N7505 has a single synthesizer that is used to generate right frequencies for both TX and RX. The synthesizer consists of:

- PLL (Phase-Locked Loop)
- loop filter
- VCO (Voltage Controlled Oscillator)
- balun

The VCO frequencies are locked by PLLs into a reference oscillator, VCTCXO (Voltage Controlled Temperature Compensated Crystal Oscillator).

The PLLs is controlled via RFBus.

The VCOs operate at the channel frequency multiplied by two in the upper bands (for example, GSM1800/1900) and by four in EGSM900 and GSM850. The required frequency dividers required for modulators and demodulators are integrated in N7505.

## Reference oscillators

A 38.4MHz VCTCXO is used as a reference oscillator for the frequency synthesizers.

### Regulators

N7505 contains integrated regulators to supply regulated voltages for their internal circuitry and other RF parts.


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## Frequency mappings

### GSM850 frequencies

| CH | TX | RX | VCO TX | VCO RX | CH | TX | RX | VCO TX | VCO RX | CH | TX | RX | VCO TX | VCO RX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 128 | 824.2 | 869.2 | 3296.8 | 3476.8 | 170 | 832.6 | 877.6 | 3330.4 | 3510.4 | 212 | 841.0 | 886.0 | 3364.0 | 3544.0 |
| 129 | 824.4 | 869.4 | 3297.6 | 3477.6 | 171 | 832.8 | 877.8 | 3331.2 | 3511.2 | 213 | 841.2 | 886.2 | 3364.8 | 3544.8 |
| 130 | 824.6 | 869.6 | 3298.4 | 3478.4 | 172 | 833.0 | 878.0 | 3332.0 | 3512.0 | 214 | 841.4 | 886.4 | 3365.6 | 3545.6 |
| 131 | 824.8 | 869.8 | 3299.2 | 3479.2 | 173 | 833.2 | 878.2 | 3332.8 | 3512.8 | 215 | 841.6 | 886.6 | 3366.4 | 3546.4 |
| 132 | 825.0 | 870.0 | 3300.0 | 3480.0 | 174 | 833.4 | 878.4 | 3333.6 | 3513.6 | 216 | 841.8 | 886.8 | 3367.2 | 3547.2 |
| 133 | 825.2 | 870.2 | 3300.8 | 3480.8 | 175 | 833.6 | 878.6 | 3334.4 | 3514.4 | 217 | 842.0 | 887.0 | 3368.0 | 3548.0 |
| 134 | 825.4 | 870.4 | 3301.6 | 3481.6 | 176 | 833.8 | 878.8 | 3335.2 | 3515.2 | 218 | 842.2 | 887.2 | 3368.8 | 3548.8 |
| 135 | 825.6 | 870.6 | 3302.4 | 3482.4 | 177 | 834.0 | 879.0 | 3336.0 | 3516.0 | 219 | 842.4 | 887.4 | 3369.6 | 3549.6 |
| 136 | 825.8 | 870.8 | 3303.2 | 3483.2 | 178 | 834.2 | 879.2 | 3336.8 | 3516.8 | 220 | 842.6 | 887.6 | 3370.4 | 3550.4 |
| 137 | 826.0 | 871.0 | 3304.0 | 3484.0 | 179 | 834.4 | 879.4 | 3337.6 | 3517.6 | 221 | 842.8 | 887.8 | 3371.2 | 3551.2 |
| 138 | 826.2 | 871.2 | 3304.8 | 3484.8 | 180 | 834.6 | 879.6 | 3338.4 | 3518.4 | 222 | 843.0 | 888.0 | 3372.0 | 3552.0 |
| 139 | 826.4 | 871.4 | 3305.6 | 3485.6 | 181 | 834.8 | 879.8 | 3339.2 | 3519.2 | 223 | 843.2 | 888.2 | 3372.8 | 3552.8 |
| 140 | 826.6 | 871.6 | 3306.4 | 3486.4 | 182 | 835.0 | 880.0 | 3340.0 | 3520.0 | 224 | 843.4 | 888.4 | 3373.6 | 3553.6 |
| 141 | 826.8 | 871.8 | 3307.2 | 3487.2 | 183 | 835.2 | 880.2 | 3340.8 | 3520.8 | 225 | 843.6 | 888.6 | 3374.4 | 3554.4 |
| 142 | 827.0 | 872.0 | 3308.0 | 3488.0 | 184 | 835.4 | 880.4 | 3341.6 | 3521.6 | 226 | 843.8 | 888.8 | 3375.2 | 3555.2 |
| 143 | 827.2 | 872.2 | 3308.8 | 3488.8 | 185 | 835.6 | 880.6 | 3342.4 | 3522.4 | 227 | 844.0 | 889.0 | 3376.0 | 3556.0 |
| 144 | 827.4 | 872.4 | 3309.6 | 3489.6 | 186 | 835.8 | 880.8 | 3343.2 | 3523.2 | 228 | 844.2 | 889.2 | 3376.8 | 3556.8 |
| 145 | 827.6 | 872.6 | 3310.4 | 3490.4 | 187 | 836.0 | 881.0 | 3344.0 | 3524.0 | 229 | 844.4 | 889.4 | 3377.6 | 3557.6 |
| 146 | 827.8 | 872.8 | 3311.2 | 3491.2 | 188 | 836.2 | 881.2 | 3344.8 | 3524.8 | 230 | 844.6 | 889.6 | 3378.4 | 3558.4 |
| 147 | 828.0 | 873.0 | 3312.0 | 3492.0 | 189 | 836.4 | 881.4 | 3345.6 | 3525.6 | 231 | 844.8 | 889.8 | 3379.2 | 3559.2 |
| 148 | 828.2 | 873.2 | 3312.8 | 3492.8 | 190 | 836.6 | 881.6 | 3346.4 | 3526.4 | 232 | 845.0 | 890.0 | 3380.0 | 3560.0 |
| 149 | 828.4 | 873.4 | 3313.6 | 3493.6 | 191 | 836.8 | 881.8 | 3347.2 | 3527.2 | 233 | 845.2 | 890.2 | 3380.8 | 3560.8 |
| 150 | 828.6 | 873.6 | 3314.4 | 3494.4 | 192 | 837.0 | 882.0 | 3348.0 | 3528.0 | 234 | 845.4 | 890.4 | 3381.6 | 3561.6 |
| 151 | 828.8 | 873.8 | 3315.2 | 3495.2 | 193 | 837.2 | 882.2 | 3348.8 | 3528.8 | 235 | 845.6 | 890.6 | 3382.4 | 3562.4 |
| 152 | 829.0 | 874.0 | 3316.0 | 3496.0 | 194 | 837.4 | 882.4 | 3349.6 | 3529.6 | 236 | 845.8 | 890.8 | 3383.2 | 3563.2 |
| 153 | 829.2 | 874.2 | 3316.8 | 3496.8 | 195 | 837.6 | 882.6 | 3350.4 | 3530.4 | 237 | 846.0 | 891.0 | 3384.0 | 3564.0 |
| 154 | 829.4 | 874.4 | 3317.6 | 3497.6 | 196 | 837.8 | 882.8 | 3351.2 | 3531.2 | 238 | 846.2 | 891.2 | 3384.8 | 3564.8 |
| 155 | 829.6 | 874.6 | 3318.4 | 3498.4 | 197 | 838.0 | 883.0 | 3352.0 | 3532.0 | 239 | 846.4 | 891.4 | 3385.6 | 3565.6 |
| 156 | 829.8 | 874.8 | 3319.2 | 3499.2 | 198 | 838.2 | 883.2 | 3352.8 | 3532.8 | 240 | 846.6 | 891.6 | 3386.4 | 3566.4 |
| 157 | 830.0 | 875.0 | 3320.0 | 3500.0 | 199 | 838.4 | 883.4 | 3353.6 | 3533.6 | 241 | 846.8 | 891.8 | 3387.2 | 3567.2 |
| 158 | 830.2 | 875.2 | 3320.8 | 3500.8 | 200 | 838.6 | 883.6 | 3354.4 | 3534.4 | 242 | 847.0 | 892.0 | 3388.0 | 3568.0 |
| 159 | 830.4 | 875.4 | 3321.6 | 3501.6 | 201 | 838.8 | 883.8 | 3355.2 | 3535.2 | 243 | 847.2 | 892.2 | 3388.8 | 3568.8 |
| 160 | 830.6 | 875.6 | 3322.4 | 3502.4 | 202 | 839.0 | 884.0 | 3356.0 | 3536.0 | 244 | 847.4 | 892.4 | 3389.6 | 3569.6 |
| 161 | 830.8 | 875.8 | 3323.2 | 3503.2 | 203 | 839.2 | 884.2 | 3356.8 | 3536.8 | 245 | 847.6 | 892.6 | 3390.4 | 3570.4 |
| 162 | 831.0 | 876.0 | 3324.0 | 3504.0 | 204 | 839.4 | 884.4 | 3357.6 | 3537.6 | 246 | 847.8 | 892.8 | 3391.2 | 3571.2 |
| 163 | 831.2 | 876.2 | 3324.8 | 3504.8 | 205 | 839.6 | 884.6 | 3358.4 | 3538.4 | 247 | 848.0 | 893.0 | 3392.0 | 3572.0 |
| 164 | 831.4 | 876.4 | 3325.6 | 3505.6 | 206 | 839.8 | 884.8 | 3359.2 | 3539.2 | 248 | 848.2 | 893.2 | 3392.8 | 3572.8 |
| 165 | 831.6 | 876.6 | 3326.4 | 3506.4 | 207 | 840.0 | 885.0 | 3360.0 | 3540.0 | 249 | 848.4 | 893.4 | 3393.6 | 3573.6 |
| 166 | 831.8 | 876.8 | 3327.2 | 3507.2 | 208 | 840.2 | 885.2 | 3360.8 | 3540.8 | 250 | 848.6 | 893.6 | 3394.4 | 3574.4 |
| 167 | 832.0 | 877.0 | 3328.0 | 3508.0 | 209 | 840.4 | 885.4 | 3361.6 | 3541.6 | 251 | 848.8 | 893.8 | 3395.2 | 3575.2 |


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## EGSM900 frequencies

| CH | TX | RX | VCO TX | VCO RX | CH | TX | RX | VCO TX | VCO RX | CH | TX | RX | VCO TX | VCO RX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 975 | 880,2 | 925,2 | 3520,8 | 3700,8 | 1 | 890,2 | 935,2 | 3560,8 | 3740,8 | 63 | 902,6 | 947,6 | 3610,4 | 3790,4 |
| 976 | 880,4 | 925,4 | 3521,6 | 3701,6 | 2 | 890,4 | 935,4 | 3561,6 | 3741,6 | 64 | 902,8 | 947,8 | 3611,2 | 3791,2 |
| 977 | 880,6 | 925,6 | 3522,4 | 3702,4 | 3 | 890,6 | 935,6 | 3562,4 | 3742,4 | 65 | 903,0 | 948,0 | 3612,0 | 3792,0 |
| 978 | 880,8 | 925,8 | 3523,2 | 3703,2 | 4 | 890,8 | 935,8 | 3563,2 | 3743,2 | 66 | 903,2 | 948,2 | 3612,8 | 3792,8 |
| 979 | 881,0 | 926,0 | 3524,0 | 3704,0 | 5 | 891,0 | 936,0 | 3564,0 | 3744,0 | 67 | 903,4 | 948,4 | 3613,6 | 3793,6 |
| 980 | 881,2 | 926,2 | 3524,8 | 3704,8 | 6 | 891,2 | 936,2 | 3564,8 | 3744,8 | 68 | 903,6 | 948,6 | 3614,4 | 3794,4 |
| 981 | 881,4 | 926,4 | 3525,6 | 3705,6 | 7 | 891,4 | 936,4 | 3565,6 | 3745,6 | 69 | 903,8 | 948,8 | 3615,2 | 3795,2 |
| 982 | 881,6 | 926,6 | 3526,4 | 3706,4 | 8 | 891,6 | 936,6 | 3566,4 | 3746,4 | 70 | 904,0 | 949,0 | 3616,0 | 3796,0 |
| 983 | 881,8 | 926,8 | 3527,2 | 3707,2 | 9 | 891,8 | 936,8 | 3567,2 | 3747,2 | 71 | 904,2 | 949,2 | 3616,8 | 3796,8 |
| 984 | 882,0 | 927,0 | 3528,0 | 3708,0 | 10 | 892,0 | 937,0 | 3568,0 | 3748,0 | 72 | 904,4 | 949,4 | 3617,6 | 3797,6 |
| 985 | 882,2 | 927,2 | 3528,8 | 3708,8 | 11 | 892,2 | 937,2 | 3568,8 | 3748,8 | 73 | 904,6 | 949,6 | 3618,4 | 3798,4 |
| 986 | 882,4 | 927,4 | 3529,6 | 3709,6 | 12 | 892,4 | 937,4 | 3569,6 | 3749,6 | 74 | 904,8 | 949,8 | 3619,2 | 3799,2 |
| 987 | 882,6 | 927,6 | 3530,4 | 3710,4 | 13 | 892,6 | 937,6 | 3570,4 | 3750,4 | 75 | 905,0 | 950,0 | 3620,0 | 3800,0 |
| 988 | 882,8 | 927,8 | 3531,2 | 3711,2 | 14 | 892,8 | 937,8 | 3571,2 | 3751,2 | 76 | 905,2 | 950,2 | 3620,8 | 3800,8 |
| 989 | 883,0 | 928,0 | 3532,0 | 3712,0 | 15 | 893,0 | 938,0 | 3572,0 | 3752,0 | 77 | 905,4 | 950,4 | 3621,6 | 3801,6 |
| 990 | 883,2 | 928,2 | 3532,8 | 3712,8 | 16 | 893,2 | 938,2 | 3572,8 | 3752,8 | 78 | 905,6 | 950,6 | 3622,4 | 3802,4 |
| 991 | 883,4 | 928,4 | 3533,6 | 3713,6 | 17 | 893,4 | 938,4 | 3573,6 | 3753,6 | 79 | 905,8 | 950,8 | 3623,2 | 3803,2 |
| 992 | 883,6 | 928,6 | 3534,4 | 3714,4 | 18 | 893,6 | 938,6 | 3574,4 | 3754,4 | 80 | 906,0 | 951,0 | 3624,0 | 3804,0 |
| 993 | 883,8 | 928,8 | 3535,2 | 3715,2 | 19 | 893,8 | 938,8 | 3575,2 | 3755,2 | 81 | 906,2 | 951,2 | 3624,8 | 3804,8 |
| 994 | 884,0 | 929,0 | 3536,0 | 3716,0 | 20 | 894,0 | 939,0 | 3576,0 | 3756,0 | 82 | 906,4 | 951,4 | 3625,6 | 3805,6 |
| 995 | 884,2 | 929,2 | 3536,8 | 3716,8 | 21 | 894,2 | 939,2 | 3576,8 | 3756,8 | 83 | 906,6 | 951,6 | 3626,4 | 3806,4 |
| 996 | 884,4 | 929,4 | 3537,6 | 3717,6 | 22 | 894,4 | 939,4 | 3577,6 | 3757,6 | 84 | 906,8 | 951,8 | 3627,2 | 3807,2 |
| 997 | 884,6 | 929,6 | 3538,4 | 3718,4 | 23 | 894,6 | 939,6 | 3578,4 | 3758,4 | 85 | 907,0 | 952,0 | 3628,0 | 3808,0 |
| 998 | 884,8 | 929,8 | 3539,2 | 3719,2 | 24 | 894,8 | 939,8 | 3579,2 | 3759,2 | 86 | 907,2 | 952,2 | 3628,8 | 3808,8 |
| 999 | 885,0 | 930,0 | 3540,0 | 3720,0 | 25 | 895,0 | 940,0 | 3580,0 | 3760,0 | 87 | 907,4 | 952,4 | 3629,6 | 3809,6 |
| 1000 | 885,2 | 930,2 | 3540,8 | 3720,8 | 26 | 895,2 | 940,2 | 3580,8 | 3760,8 | 88 | 907,6 | 952,6 | 3630,4 | 3810,4 |
| 1001 | 885,4 | 930,4 | 3541,6 | 3721,6 | 27 | 895,4 | 940,4 | 3581,6 | 3761,6 | 89 | 907,8 | 952,8 | 3631,2 | 3811,2 |
| 1002 | 885,6 | 930,6 | 3542,4 | 3722,4 | 28 | 895,6 | 940,6 | 3582,4 | 3762,4 | 90 | 908,0 | 953,0 | 3632,0 | 3812,0 |
| 1003 | 885,8 | 930,8 | 3543,2 | 3723,2 | 29 | 895,8 | 940,8 | 3583,2 | 3763,2 | 91 | 908,2 | 953,2 | 3632,8 | 3812,8 |
| 1004 | 886,0 | 931,0 | 3544,0 | 3724,0 | 30 | 896,0 | 941,0 | 3584,0 | 3764,0 | 92 | 908,4 | 953,4 | 3633,6 | 3813,6 |
| 1005 | 886,2 | 931,2 | 3544,8 | 3724,8 | 31 | 896,2 | 941,2 | 3584,8 | 3764,8 | 93 | 908,6 | 953,6 | 3634,4 | 3814,4 |
| 1006 | 886,4 | 931,4 | 3545,6 | 3725,6 | 32 | 896,4 | 941,4 | 3585,6 | 3765,6 | 94 | 908,8 | 953,8 | 3635,2 | 3815,2 |
| 1007 | 886,6 | 931,6 | 3546,4 | 3726,4 | 33 | 896,6 | 941,6 | 3586,4 | 3766,4 | 95 | 909,0 | 954,0 | 3636,0 | 3816,0 |
| 1008 | 886,8 | 931,8 | 3547,2 | 3727,2 | 34 | 896,8 | 941,8 | 3587,2 | 3767,2 | 96 | 909,2 | 954,2 | 3636,8 | 3816,8 |
| 1009 | 887,0 | 932,0 | 3548,0 | 3728,0 | 35 | 897,0 | 942,0 | 3588,0 | 3768,0 | 97 | 909,4 | 954,4 | 3637,6 | 3817,6 |
| 1010 | 887,2 | 932,2 | 3548,8 | 3728,8 | 36 | 897,2 | 942,2 | 3588,8 | 3768,8 | 98 | 909,6 | 954,6 | 3638,4 | 3818,4 |
| 1011 | 887,4 | 932,4 | 3549,6 | 3729,6 | 37 | 897,4 | 942,4 | 3589,6 | 3769,6 | 99 | 909,8 | 954,8 | 3639,2 | 3819,2 |
| 1012 | 887,6 | 932,6 | 3550,4 | 3730,4 | 38 | 897,6 | 942,6 | 3590,4 | 3770,4 | 100 | 910,0 | 955,0 | 3640,0 | 3820,0 |
| 1013 | 887,8 | 932,8 | 3551,2 | 3731,2 | 39 | 897,8 | 942,8 | 3591,2 | 3771,2 | 101 | 910,2 | 955,2 | 3640,8 | 3820,8 |
| 1014 | 888,0 | 933,0 | 3552,0 | 3732,0 | 40 | 898,0 | 943,0 | 3592,0 | 3772,0 | 102 | 910,4 | 955,4 | 3641,6 | 3821,6 |
| 1015 | 888,2 | 933,2 | 3552,8 | 3732,8 | 41 | 898,2 | 943,2 | 3592,8 | 3772,8 | 103 | 910,6 | 955,6 | 3642,4 | 3822,4 |
| 1016 | 888,4 | 933,4 | 3553,6 | 3733,6 | 42 | 898,4 | 943,4 | 3593,6 | 3773,6 | 104 | 910,8 | 955,8 | 3643,2 | 3823,2 |
| 1017 | 888,6 | 933,6 | 3554,4 | 3734,4 | 43 | 898,6 | 943,6 | 3594,4 | 3774,4 | 105 | 911,0 | 956,0 | 3644,0 | 3824,0 |
| 1018 | 888,8 | 933,8 | 3555,2 | 3735,2 | 44 | 898,8 | 943,8 | 3595,2 | 3775,2 | 106 | 911,2 | 956,2 | 3644,8 | 3824,8 |
| 1019 | 889,0 | 934,0 | 3556,0 | 3736,0 | 45 | 899,0 | 944,0 | 3596,0 | 3776,0 | 107 | 911,4 | 956,4 | 3645,6 | 3825,6 |
| 1020 | 889,2 | 934,2 | 3556,8 | 3736,8 | 46 | 899,2 | 944,2 | 3596,8 | 3776,8 | 108 | 911,6 | 956,6 | 3646,4 | 3826,4 |
| 1021 | 889,4 | 934,4 | 3557,6 | 3737,6 | 47 | 899,4 | 944,4 | 3597,6 | 3777,6 | 109 | 911,8 | 956,8 | 3647,2 | 3827,2 |
| 1022 | 889,6 | 934,6 | 3558,4 | 3738,4 | 48 | 899,6 | 944,6 | 3598,4 | 3778,4 | 110 | 912,0 | 957,0 | 3648,0 | 3828,0 |
| 1023 | 889,8 | 934,8 | 3559,2 | 3739,2 | 49 | 899,8 | 944,8 | 3599,2 | 3779,2 | 111 | 912,2 | 957,2 | 3648,8 | 3828,8 |
| 0 | 890,0 | 935,0 | 3560,0 | 3740,0 | 50 | 900,0 | 945,0 | 3600,0 | 3780,0 | 112 | 912,4 | 957,4 | 3649,6 | 3829,6 |
| | | | | | 51 | 900,2 | 945,2 | 3600,8 | 3780,8 | 113 | 912,6 | 957,6 | 3650,4 | 3830,4 |
| | | | | | 52 | 900,4 | 945,4 | 3601,6 | 3781,6 | 114 | 912,8 | 957,8 | 3651,2 | 3831,2 |
| | | | | | 53 | 900,6 | 945,6 | 3602,4 | 3782,4 | 115 | 913,0 | 958,0 | 3652,0 | 3832,0 |
| | | | | | 54 | 900,8 | 945,8 | 3603,2 | 3783,2 | 116 | 913,2 | 958,2 | 3652,8 | 3832,8 |
| | | | | | 55 | 901,0 | 946,0 | 3604,0 | 3784,0 | 117 | 913,4 | 958,4 | 3653,6 | 3833,6 |
| | | | | | 56 | 901,2 | 946,2 | 3604,8 | 3784,8 | 118 | 913,6 | 958,6 | 3654,4 | 3834,4 |
| | | | | | 57 | 901,4 | 946,4 | 3605,6 | 3785,6 | 119 | 913,8 | 958,8 | 3655,2 | 3835,2 |
| | | | | | 58 | 901,6 | 946,6 | 3606,4 | 3786,4 | 120 | 914,0 | 959,0 | 3656,0 | 3836,0 |
| | | | | | 59 | 901,8 | 946,8 | 3607,2 | 3787,2 | 121 | 914,2 | 959,2 | 3656,8 | 3836,8 |
| | | | | | 60 | 902,0 | 947,0 | 3608,0 | 3788,0 | 122 | 914,4 | 959,4 | 3657,6 | 3837,6 |
| | | | | | 61 | 902,2 | 947,2 | 3608,8 | 3788,8 | 123 | 914,6 | 959,6 | 3658,4 | 3838,4 |
| | | | | | 62 | 902,4 | 947,4 | 3609,6 | 3789,6 | 124 | 914,8 | 959,8 | 3659,2 | 3839,2 |


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## GSM1800 frequencies

| Ch | Tx | Rx | VCO Tx | VCO Rx | Ch | Tx | Rx | VCO Tx | VCO Rx | Ch | Tx | Rx | VCO Tx | VCO Rx | Ch | Tx | Rx | VCO Tx | VCO Rx |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 512 | 1710.2 | 1805.2 | 3420.4 | 3610.4 | 606 | 1729.0 | 1824.0 | 3458.0 | 3648.0 | 700 | 1747.8 | 1842.8 | 3495.6 | 3685.6 | 793 | 1766.4 | 1861.4 | 3532.8 | 3722.8 |
| 513 | 1710.4 | 1805.4 | 3420.8 | 3610.8 | 607 | 1729.2 | 1824.2 | 3458.4 | 3648.4 | 701 | 1748.0 | 1843.0 | 3496.0 | 3686.0 | 794 | 1766.6 | 1861.6 | 3533.2 | 3723.2 |
| 514 | 1710.6 | 1805.6 | 3421.2 | 3611.2 | 608 | 1729.4 | 1824.4 | 3458.8 | 3648.8 | 702 | 1748.2 | 1843.2 | 3496.4 | 3686.4 | 795 | 1766.8 | 1861.8 | 3533.6 | 3723.6 |
| 515 | 1710.8 | 1805.8 | 3421.6 | 3611.6 | 609 | 1729.6 | 1824.6 | 3459.2 | 3649.2 | 703 | 1748.4 | 1843.4 | 3496.8 | 3686.8 | 796 | 1767.0 | 1862.0 | 3534.0 | 3724.0 |
| 516 | 1711.0 | 1806.0 | 3422.0 | 3612.0 | 610 | 1729.8 | 1824.8 | 3459.6 | 3649.6 | 704 | 1748.6 | 1843.6 | 3497.2 | 3687.2 | 797 | 1767.2 | 1862.2 | 3534.4 | 3724.4 |
| 517 | 1711.2 | 1806.2 | 3422.4 | 3612.4 | 611 | 1730.0 | 1825.0 | 3460.0 | 3650.0 | 705 | 1748.8 | 1843.8 | 3497.6 | 3687.6 | 798 | 1767.4 | 1862.4 | 3534.8 | 3724.8 |
| 518 | 1711.4 | 1806.4 | 3422.8 | 3612.8 | 612 | 1730.2 | 1825.2 | 3460.4 | 3650.4 | 706 | 1749.0 | 1844.0 | 3498.0 | 3688.0 | 799 | 1767.6 | 1862.6 | 3535.2 | 3725.2 |
| 519 | 1711.6 | 1806.6 | 3423.2 | 3613.2 | 613 | 1730.4 | 1825.4 | 3460.8 | 3650.8 | 707 | 1749.2 | 1844.2 | 3498.4 | 3688.4 | 800 | 1767.8 | 1862.8 | 3535.6 | 3725.6 |
| 520 | 1711.8 | 1806.8 | 3423.6 | 3613.6 | 614 | 1730.6 | 1825.6 | 3461.2 | 3651.2 | 708 | 1749.4 | 1844.4 | 3498.8 | 3688.8 | 801 | 1768.0 | 1863.0 | 3536.0 | 3726.0 |
| 521 | 1712.0 | 1807.0 | 3424.0 | 3614.0 | 615 | 1730.8 | 1825.8 | 3461.6 | 3651.6 | 709 | 1749.6 | 1844.6 | 3499.2 | 3689.2 | 802 | 1768.2 | 1863.2 | 3536.4 | 3726.4 |
| 522 | 1712.2 | 1807.2 | 3424.4 | 3614.4 | 616 | 1731.0 | 1826.0 | 3462.0 | 3652.0 | 710 | 1749.8 | 1844.8 | 3499.6 | 3689.6 | 803 | 1768.4 | 1863.4 | 3536.8 | 3726.8 |
| 523 | 1712.4 | 1807.4 | 3424.8 | 3614.8 | 617 | 1731.2 | 1826.2 | 3462.4 | 3652.4 | 711 | 1750.0 | 1845.0 | 3500.0 | 3690.0 | 804 | 1768.6 | 1863.6 | 3537.2 | 3727.2 |
| 524 | 1712.6 | 1807.6 | 3425.2 | 3615.2 | 618 | 1731.4 | 1826.4 | 3462.8 | 3652.8 | 712 | 1750.2 | 1845.2 | 3500.4 | 3690.4 | 805 | 1768.8 | 1863.8 | 3537.6 | 3727.6 |
| 525 | 1712.8 | 1807.8 | 3425.6 | 3615.6 | 619 | 1731.6 | 1826.6 | 3463.2 | 3653.2 | 713 | 1750.4 | 1845.4 | 3500.8 | 3690.8 | 806 | 1769.0 | 1864.0 | 3538.0 | 3728.0 |
| 526 | 1713.0 | 1808.0 | 3426.0 | 3616.0 | 620 | 1731.8 | 1826.8 | 3463.6 | 3653.6 | 714 | 1750.6 | 1845.6 | 3501.2 | 3691.2 | 807 | 1769.2 | 1864.2 | 3538.4 | 3728.4 |
| 527 | 1713.2 | 1808.2 | 3426.4 | 3616.4 | 621 | 1732.0 | 1827.0 | 3464.0 | 3654.0 | 715 | 1750.8 | 1845.8 | 3501.6 | 3691.6 | 808 | 1769.4 | 1864.4 | 3538.8 | 3728.8 |
| 528 | 1713.4 | 1808.4 | 3426.8 | 3616.8 | 622 | 1732.2 | 1827.2 | 3464.4 | 3654.4 | 716 | 1751.0 | 1846.0 | 3502.0 | 3692.0 | 809 | 1769.6 | 1864.6 | 3539.2 | 3729.2 |
| 529 | 1713.6 | 1808.6 | 3427.2 | 3617.2 | 623 | 1732.4 | 1827.4 | 3464.8 | 3654.8 | 717 | 1751.2 | 1846.2 | 3502.4 | 3692.4 | 810 | 1769.8 | 1864.8 | 3539.6 | 3729.6 |
| 530 | 1713.8 | 1808.8 | 3427.6 | 3617.6 | 624 | 1732.6 | 1827.6 | 3465.2 | 3655.2 | 718 | 1751.4 | 1846.4 | 3502.8 | 3692.8 | 811 | 1770.0 | 1865.0 | 3540.0 | 3730.0 |
| 531 | 1714.0 | 1809.0 | 3428.0 | 3618.0 | 625 | 1732.8 | 1827.8 | 3465.6 | 3655.6 | 719 | 1751.6 | 1846.6 | 3503.2 | 3693.2 | 812 | 1770.2 | 1865.2 | 3540.4 | 3730.4 |
| 532 | 1714.2 | 1809.2 | 3428.4 | 3618.4 | 626 | 1733.0 | 1828.0 | 3466.0 | 3656.0 | 720 | 1751.8 | 1846.8 | 3503.6 | 3693.6 | 813 | 1770.4 | 1865.4 | 3540.8 | 3730.8 |
| 533 | 1714.4 | 1809.4 | 3428.8 | 3618.8 | 627 | 1733.2 | 1828.2 | 3466.4 | 3656.4 | 721 | 1752.0 | 1847.0 | 3504.0 | 3694.0 | 814 | 1770.6 | 1865.6 | 3541.2 | 3731.2 |
| 534 | 1714.6 | 1809.6 | 3429.2 | 3619.2 | 628 | 1733.4 | 1828.4 | 3466.8 | 3656.8 | 722 | 1752.2 | 1847.2 | 3504.4 | 3694.4 | 815 | 1770.8 | 1865.8 | 3541.6 | 3731.6 |
| 535 | 1714.8 | 1809.8 | 3429.6 | 3619.6 | 629 | 1733.6 | 1828.6 | 3467.2 | 3657.2 | 723 | 1752.4 | 1847.4 | 3504.8 | 3694.8 | 816 | 1771.0 | 1866.0 | 3542.0 | 3732.0 |
| 536 | 1715.0 | 1810.0 | 3430.0 | 3620.0 | 630 | 1733.8 | 1828.8 | 3467.6 | 3657.6 | 724 | 1752.6 | 1847.6 | 3505.2 | 3695.2 | 817 | 1771.2 | 1866.2 | 3542.4 | 3732.4 |
| 537 | 1715.2 | 1810.2 | 3430.4 | 3620.4 | 631 | 1734.0 | 1829.0 | 3468.0 | 3658.0 | 725 | 1752.8 | 1847.8 | 3505.6 | 3695.6 | 818 | 1771.4 | 1866.4 | 3542.8 | 3732.8 |
| 538 | 1715.4 | 1810.4 | 3430.8 | 3620.8 | 632 | 1734.2 | 1829.2 | 3468.4 | 3658.4 | 726 | 1753.0 | 1848.0 | 3506.0 | 3696.0 | 819 | 1771.6 | 1866.6 | 3543.2 | 3733.2 |
| 539 | 1715.6 | 1810.6 | 3431.2 | 3621.2 | 633 | 1734.4 | 1829.4 | 3468.8 | 3658.8 | 727 | 1753.2 | 1848.2 | 3506.4 | 3696.4 | 820 | 1771.8 | 1866.8 | 3543.6 | 3733.6 |
| 540 | 1715.8 | 1810.8 | 3431.6 | 3621.6 | 634 | 1734.6 | 1829.6 | 3469.2 | 3659.2 | 728 | 1753.4 | 1848.4 | 3506.8 | 3696.8 | 821 | 1772.0 | 1867.0 | 3544.0 | 3734.0 |
| 541 | 1716.0 | 1811.0 | 3432.0 | 3622.0 | 635 | 1734.8 | 1829.8 | 3469.6 | 3659.6 | 729 | 1753.6 | 1848.6 | 3507.2 | 3697.2 | 822 | 1772.2 | 1867.2 | 3544.4 | 3734.4 |
| 542 | 1716.2 | 1811.2 | 3432.4 | 3622.4 | 636 | 1735.0 | 1830.0 | 3470.0 | 3660.0 | 730 | 1753.8 | 1848.8 | 3507.6 | 3697.6 | 823 | 1772.4 | 1867.4 | 3544.8 | 3734.8 |
| 543 | 1716.4 | 1811.4 | 3432.8 | 3622.8 | 637 | 1735.2 | 1830.2 | 3470.4 | 3660.4 | 731 | 1754.0 | 1849.0 | 3508.0 | 3698.0 | 824 | 1772.6 | 1867.6 | 3545.2 | 3735.2 |
| 544 | 1716.6 | 1811.6 | 3433.2 | 3623.2 | 638 | 1735.4 | 1830.4 | 3470.8 | 3660.8 | 732 | 1754.2 | 1849.2 | 3508.4 | 3698.4 | 825 | 1772.8 | 1867.8 | 3545.6 | 3735.6 |
| 545 | 1716.8 | 1811.8 | 3433.6 | 3623.6 | 639 | 1735.6 | 1830.6 | 3471.2 | 3661.2 | 733 | 1754.4 | 1849.4 | 3508.8 | 3698.8 | 826 | 1773.0 | 1868.0 | 3546.0 | 3736.0 |
| 546 | 1717.0 | 1812.0 | 3434.0 | 3624.0 | 640 | 1735.8 | 1830.8 | 3471.6 | 3661.6 | 734 | 1754.6 | 1849.6 | 3509.2 | 3699.2 | 827 | 1773.2 | 1868.2 | 3546.4 | 3736.4 |
| 547 | 1717.2 | 1812.2 | 3434.4 | 3624.4 | 641 | 1736.0 | 1831.0 | 3472.0 | 3662.0 | 735 | 1754.8 | 1849.8 | 3509.6 | 3699.6 | 828 | 1773.4 | 1868.4 | 3546.8 | 3736.8 |
| 548 | 1717.4 | 1812.4 | 3434.8 | 3624.8 | 642 | 1736.2 | 1831.2 | 3472.4 | 3662.4 | 736 | 1755.0 | 1850.0 | 3510.0 | 3700.0 | 829 | 1773.6 | 1868.6 | 3547.2 | 3737.2 |
| 549 | 1717.6 | 1812.6 | 3435.2 | 3625.2 | 643 | 1736.4 | 1831.4 | 3472.8 | 3662.8 | 737 | 1755.2 | 1850.2 | 3510.4 | 3700.4 | 830 | 1773.8 | 1868.8 | 3547.6 | 3737.6 |
| 550 | 1717.8 | 1812.8 | 3435.6 | 3625.6 | 644 | 1736.6 | 1831.6 | 3473.2 | 3663.2 | 738 | 1755.4 | 1850.4 | 3510.8 | 3700.8 | 831 | 1774.0 | 1869.0 | 3548.0 | 3738.0 |
| 551 | 1718.0 | 1813.0 | 3436.0 | 3626.0 | 645 | 1736.8 | 1831.8 | 3473.6 | 3663.6 | 739 | 1755.6 | 1850.6 | 3511.2 | 3701.2 | 832 | 1774.2 | 1869.2 | 3548.4 | 3738.4 |
| 552 | 1718.2 | 1813.2 | 3436.4 | 3626.4 | 646 | 1737.0 | 1832.0 | 3474.0 | 3664.0 | 740 | 1755.8 | 1850.8 | 3511.6 | 3701.6 | 833 | 1774.4 | 1869.4 | 3548.8 | 3738.8 |
| 553 | 1718.4 | 1813.4 | 3436.8 | 3626.8 | 647 | 1737.2 | 1832.2 | 3474.4 | 3664.4 | 741 | 1756.0 | 1851.0 | 3512.0 | 3702.0 | 834 | 1774.6 | 1869.6 | 3549.2 | 3739.2 |
| 554 | 1718.6 | 1813.6 | 3437.2 | 3627.2 | 648 | 1737.4 | 1832.4 | 3474.8 | 3664.8 | 742 | 1756.2 | 1851.2 | 3512.4 | 3702.4 | 835 | 1774.8 | 1869.8 | 3549.6 | 3739.6 |
| 555 | 1718.8 | 1813.8 | 3437.6 | 3627.6 | 649 | 1737.6 | 1832.6 | 3475.2 | 3665.2 | 743 | 1756.4 | 1851.4 | 3512.8 | 3702.8 | 836 | 1775.0 | 1870.0 | 3550.0 | 3740.0 |
| 556 | 1719.0 | 1814.0 | 3438.0 | 3628.0 | 650 | 1737.8 | 1832.8 | 3475.6 | 3665.6 | 744 | 1756.6 | 1851.6 | 3513.2 | 3703.2 | 837 | 1775.2 | 1870.2 | 3550.4 | 3740.4 |
| 557 | 1719.2 | 1814.2 | 3438.4 | 3628.4 | 651 | 1738.0 | 1833.0 | 3476.0 | 3666.0 | 745 | 1756.8 | 1851.8 | 3513.6 | 3703.6 | 838 | 1775.4 | 1870.4 | 3550.8 | 3740.8 |
| 558 | 1719.4 | 1814.4 | 3438.8 | 3628.8 | 652 | 1738.2 | 1833.2 | 3476.4 | 3666.4 | 746 | 1757.0 | 1852.0 | 3514.0 | 3704.0 | 839 | 1775.6 | 1870.6 | 3551.2 | 3741.2 |
| 559 | 1719.6 | 1814.6 | 3439.2 | 3629.2 | 653 | 1738.4 | 1833.4 | 3476.8 | 3666.8 | 747 | 1757.2 | 1852.2 | 3514.4 | 3704.4 | 840 | 1775.8 | 1870.8 | 3551.6 | 3741.6 |
| 560 | 1719.8 | 1814.8 | 3439.6 | 3629.6 | 654 | 1738.6 | 1833.6 | 3477.2 | 3667.2 | 748 | 1757.4 | 1852.4 | 3514.8 | 3704.8 | 841 | 1776.0 | 1871.0 | 3552.0 | 3742.0 |
| 561 | 1720.0 | 1815.0 | 3440.0 | 3630.0 | 655 | 1738.8 | 1833.8 | 3477.6 | 3667.6 | 749 | 1757.6 | 1852.6 | 3515.2 | 3705.2 | 842 | 1776.2 | 1871.2 | 3552.4 | 3742.4 |
| 562 | 1720.2 | 1815.2 | 3440.4 | 3630.4 | 656 | 1739.0 | 1834.0 | 3478.0 | 3668.0 | 750 | 1757.8 | 1852.8 | 3515.6 | 3705.6 | 843 | 1776.4 | 1871.4 | 3552.8 | 3742.8 |
| 563 | 1720.4 | 1815.4 | 3440.8 | 3630.8 | 657 | 1739.2 | 1834.2 | 3478.4 | 3668.4 | 751 | 1758.0 | 1853.0 | 3516.0 | 3706.0 | 844 | 1776.6 | 1871.6 | 3553.2 | 3743.2 |
| 564 | 1720.6 | 1815.6 | 3441.2 | 3631.2 | 658 | 1739.4 | 1834.4 | 3478.8 | 3668.8 | 752 | 1758.2 | 1853.2 | 3516.4 | 3706.4 | 845 | 1776.8 | 1871.8 | 3553.6 | 3743.6 |
| 565 | 1720.8 | 1815.8 | 3441.6 | 3631.6 | 659 | 1739.6 | 1834.6 | 3479.2 | 3669.2 | 753 | 1758.4 | 1853.4 | 3516.8 | 3706.8 | 846 | 1777.0 | 1872.0 | 3554.0 | 3744.0 |
| 566 | 1721.0 | 1816.0 | 3442.0 | 3632.0 | 660 | 1739.8 | 1834.8 | 3479.6 | 3669.6 | 754 | 1758.6 | 1853.6 | 3517.2 | 3707.2 | 847 | 1777.2 | 1872.2 | 3554.4 | 3744.4 |
| 567 | 1721.2 | 1816.2 | 3442.4 | 3632.4 | 661 | 1740.0 | 1835.0 | 3480.0 | 3670.0 | 755 | 1758.8 | 1853.8 | 3517.6 | 3707.6 | 848 | 1777.4 | 1872.4 | 3554.8 | 3744.8 |
| 568 | 1721.4 | 1816.4 | 3442.8 | 3632.8 | 662 | 1740.2 | 1835.2 | 3480.4 | 3670.4 | 756 | 1759.0 | 1854.0 | 3518.0 | 3708.0 | 849 | 1777.6 | 1872.6 | 3555.2 | 3745.2 |
| 569 | 1721.6 | 1816.6 | 3443.2 | 3633.2 | 663 | 1740.4 | 1835.4 | 3480.8 | 3670.8 | 757 | 1759.2 | 1854.2 | 3518.4 | 3708.4 | 850 | 1777.8 | 1872.8 | 3555.6 | 3745.6 |
| 570 | 1721.8 | 1816.8 | 3443.6 | 3633.6 | 664 | 1740.6 | 1835.6 | 3481.2 | 3671.2 | 758 | 1759.4 | 1854.4 | 3518.8 | 3708.8 | 851 | 1778.0 | 1873.0 | 3556.0 | 3746.0 |
| 571 | 1722.0 | 1817.0 | 3444.0 | 3634.0 | 665 | 1740.8 | 1835.8 | 3481.6 | 3671.6 | 759 | 1759.6 | 1854.6 | 3519.2 | 3709.2 | 852 | 1778.2 | 1873.2 | 3556.4 | 3746.4 |
| 572 | 1722.2 | 1817.2 | 3444.4 | 3634.4 | 666 | 1741.0 | 1836.0 | 3482.0 | 3672.0 | 760 | 1759.8 | 1854.8 | 3519.6 | 3709.6 | 853 | 1778.4 | 1873.4 | 3556.8 | 3746.8 |
| 573 | 1722.4 | 1817.4 | 3444.8 | 3634.8 | 667 | 1741.2 | 1836.2 | 3482.4 | 3672.4 | 761 | 1760.0 | 1855.0 | 3520.0 | 3710.0 | 854 | 1778.6 | 1873.6 | 3557.2 | 3747.2 |
| 574 | 1722.6 | 1817.6 | 3445.2 | 3635.2 | 668 | 1741.4 | 1836.4 | 3482.8 | 3672.8 | 762 | 1760.2 | 1855.2 | 3520.4 | 3710.4 | 855 | 1778.8 | 1873.8 | 3557.6 | 3747.6 |
| 575 | 1722.8 | 1817.8 | 3445.6 | 3635.6 | 669 | 1741.6 | 1836.6 | 3483.2 | 3673.2 | 763 | 1760.4 | 1855.4 | 3520.8 | 3710.8 | 856 | 1779.0 | 1874.0 | 3558.0 | 3748.0 |
| 576 | 1723.0 | 1818.0 | 3446.0 | 3636.0 | 670 | 1741.8 | 1836.8 | 3483.6 | 3673.6 | 764 | 1760.6 | 1855.6 | 3521.2 | 3711.2 | 857 | 1779.2 | 1874.2 | 3558.4 | 3748.4 |
| 577 | 1723.2 | 1818.2 | 3446.4 | 3636.4 | 671 | 1742.0 | 1837.0 | 3484.0 | 3674.0 | 765 | 1760.8 | 1855.8 | 3521.6 | 3711.6 | 858 | 1779.4 | 1874.4 | 3558.8 | 3748.8 |
| 578 | 1723.4 | 1818.4 | 3446.8 | 3636.8 | 672 | 1742.2 | 1837.2 | 3484.4 | 3674.4 | 766 | 1761.0 | 1856.0 | 3522.0 | 3712.0 | 859 | 1779.6 | 1874.6 | 3559.2 | 3749.2 |
| 579 | 1723.6 | 1818.6 | 3447.2 | 3637.2 | 673 | 1742.4 | 1837.4 | 3484.8 | 3674.8 | 767 | 1761.2 | 1856.2 | 3522.4 | 3712.4 | 860 | 1779.8 | 1874.8 | 3559.6 | 3749.6 |
| 580 | 1723.8 | 1818.8 | 3447.6 | 3637.6 | 674 | 1742.6 | 1837.6 | 3485.2 | 3675.2 | 768 | 1761.4 | 1856.4 | 3522.8 | 3712.8 | 861 | 1780.0 | 1875.0 | 3560.0 | 3750.0 |
| 581 | 1724.0 | 1819.0 | 3448.0 | 3638.0 | 675 | 1742.8 | 1837.8 | 3485.6 | 3675.6 | 769 | 1761.6 | 1856.6 | 3523.2 | 3713.2 | 862 | 1780.2 | 1875.2 | 3560.4 | 3750.4 |
| 582 | 1724.2 | 1819.2 | 3448.4 | 3638.4 | 676 | 1743.0 | 1838.0 | 3486.0 | 3676.0 | 770 | 1761.8 | 1856.8 | 3523.6 | 3713.6 | 863 | 1780.4 | 1875.4 | 3560.8 | 3750.8 |
| 583 | 1724.4 | 1819.4 | 3448.8 | 3638.8 | 677 | 1743.2 | 1838.2 | 3486.4 | 3676.4 | 771 | 1762.0 | 1857.0 | 3524.0 | 3714.0 | 864 | 1780.6 | 1875.6 | 3561.2 | 3751.2 |
| 584 | 1724.6 | 1819.6 | 3449.2 | 3639.2 | 678 | 1743.4 | 1838.4 | 3486.8 | 3676.8 | 772 | 1762.2 | 1857.2 | 3524.4 | 3714.4 | 865 | 1780.8 | 1875.8 | 3561.6 | 3751.6 |
| 585 | 1724.8 | 1819.8 | 3449.6 | 3639.6 | 679 | 1743.6 | 1838.6 | 3487.2 | 3677.2 | 773 | 1762.4 | 1857.4 | 3524.8 | 3714.8 | 866 | 1781.0 | 1876.0 | 3562.0 | 3752.0 |
| 586 | 1725.0 | 1820.0 | 3450.0 | 3640.0 | 680 | 1743.8 | 1838.8 | 3487.6 | 3677.6 | 774 | 1762.6 | 1857.6 | 3525.2 | 3715.2 | 867 | 1781.2 | 1876.2 | 3562.4 | 3752.4 |
| 587 | 1725.2 | 1820.2 | 3450.4 | 3640.4 | 681 | 1744.0 | 1839.0 | 3488.0 | 3678.0 | 775 | 1762.8 | 1857.8 | 3525.6 | 3715.6 | 868 | 1781.4 | 1876.4 | 3562.8 | 3752.8 |
| 588 | 1725.4 | 1820.4 | 3450.8 | 3640.8 | 682 | 1744.2 | 1839.2 | 3488.4 | 3678.4 | 776 | 1763.0 | 1858.0 | 3526.0 | 3716.0 | 869 | 1781.6 | 1876.6 | 3563.2 | 3753.2 |
| 589 | 1725.6 | 1820.6 | 3451.2 | 3641.2 | 683 | 1744.4 | 1839.4 | 3488.8 | 3678.8 | 777 | 1763.2 | 1858.2 | 3526.4 | 3716.4 | 870 | 1781.8 | 1876.8 | 3563.6 | 3753.6 |
| 590 | 1725.8 | 1820.8 | 3451.6 | 3641.6 | 684 | 1744.6 | 1839.6 | 3489.2 | 3679.2 | 778 | 1763.4 | 1858.4 | 3526.8 | 3716.8 | 871 | 1782.0 | 1877.0 | 3564.0 | 3754.0 |
| 591 | 1726.0 | 1821.0 | 3452.0 | 3642.0 | 685 | 1744.8 | 1839.8 | 3489.6 | 3679.6 | 779 | 1763.6 | 1858.6 | 3527.2 | 3717.2 | 872 | 1782.2 | 1877.2 | 3564.4 | 3754.4 |
| 592 | 1726.2 | 1821.2 | 3452.4 | 3642.4 | 686 | 1745.0 | 1840.0 | 3490.0 | 3680.0 | 780 | 1763.8 | 1858.8 | 3527.6 | 3717.6 | 873 | 1782.4 | 1877.4 | 3564.8 | 3754.8 |
| 593 | 1726.4 | 1821.4 | 3452.8 | 3642.8 | 687 | 1745.2 | 1840.2 | 3490.4 | 3680.4 | 781 | 1764.0 | 1859.0 | 3528.0 | 3718.0 | 874 | 1782.6 | 1877.6 | 3565.2 | 3755.2 |
| 594 | 1726.6 | 1821.6 | 3453.2 | 3643.2 | 688 | 1745.4 | 1840.4 | 3490.8 | 3680.8 | 782 | 1764.2 | 1859.2 | 3528.4 | 3718.4 | 875 | 1782.8 | 1877.8 | 3565.6 | 3755.6 |
| 595 | 1726.8 | 1821.8 | 3453.6 | 3643.6 | 689 | 1745.6 | 1840.6 | 3491.2 | 3681.2 | 783 | 1764.4 | 1859.4 | 3528.8 | 3718.8 | 876 | 1783.0 | 1878.0 | 3566.0 | 3756.0 |
| 596 | 1727.0 | 1822.0 | 3454.0 | 3644.0 | 690 | 1745.8 | 1840.8 | 3491.6 | 3681.6 | 784 | 1764.6 | 1859.6 | 3529.2 | 3719.2 | 877 | 1783.2 | 1878.2 | 3566.4 | 3756.4 |
| 597 | 1727.2 | 1822.2 | 3454.4 | 3644.4 | 691 | 1746.0 | 1841.0 | 3492.0 | 3682.0 | 785 | 1764.8 | 1859.8 | 3529.6 | 3719.6 | 878 | 1783.4 | 1878.4 | 3566.8 | 3756.8 |
| 598 | 1727.4 | 1822.4 | 3454.8 | 3644.8 | 692 | 1746.2 | 1841.2 | 3492.4 | 3682.4 | 786 | 1765.0 | 1860.0 | 3530.0 | 3720.0 | 879 | 1783.6 | 1878.6 | 3567.2 | 3757.2 |
| 599 | 1727.6 | 1822.6 | 3455.2 | 3645.2 | 693 | 1746.4 | 1841.4 | 3492.8 | 3682.8 | 787 | 1765.2 | 1860.2 | 3530.4 | 3720.4 | 880 | 1783.8 | 1878.8 | 3567.6 | 3757.6 |
| 600 | 1727.8 | 1822.8 | 3455.6 | 3645.6 | 694 | 1746.6 | 1841.6 | 3493.2 | 3683.2 | 788 | 1765.4 | 1860.4 | 3530.8 | 3720.8 | 881 | 1784.0 | 1879.0 | 3568.0 | 3758.0 |
| 601 | 1728.0 | 1823.0 | 3456.0 | 3646.0 | 695 | 1746.8 | 1841.8 | 3493.6 | 3683.6 | 789 | 1765.6 | 1860.6 | 3531.2 | 3721.2 | 882 | 1784.2 | 1879.2 | 3568.4 | 3758.4 |
| 602 | 1728.2 | 1823.2 | 3456.4 | 3646.4 | 696 | 1747.0 | 1842.0 | 3494.0 | 3684.0 | 790 | 1765.8 | 1860.8 | 3531.6 | 3721.6 | 883 | 1784.4 | 1879.4 | 3568.8 | 3758.8 |
| 603 | 1728.4 | 1823.4 | 3456.8 | 3646.8 | 697 | 1747.2 | 1842.2 | 3494.4 | 3684.4 | 791 | 1766.0 | 1861.0 | 3532.0 | 3722.0 | 884 | 1784.6 | 1879.6 | 3569.2 | 3759.2 |
| 604 | 1728.6 | 1823.6 | 3457.2 | 3647.2 | 698 | 1747.4 | 1842.4 | 3494.8 | 3684.8 | 792 | 1766.2 | 1861.2 | 3532.4 | 3722.4 | 885 | 1784.8 | 1879.8 | 3569.6 | 3759.6 |
| 605 | 1728.8 | 1823.8 | 3457.6 | 3647.6 | 699 | 1747.6 | 1842.6 | 3495.2 | 3685.2 | | | | | | | | | | |


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## GSM1900 frequencies

| CH | TX | RX | VCO TX | VCO RX | CH | TX | RX | VCO TX | VCO RX | CH | TX | RX | VCO TX | VCO RX | CH | TX | RX | VCO TX | VCO RX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 512 | 1850,2 | 1930,2 | 3700,4 | 3860,4 | 606 | 1869,0 | 1949,0 | 3738,0 | 3898,0 | 700 | 1887,8 | 1967,8 | 3775,6 | 3935,6 | 794 | 1906,6 | 1986,6 | 3813,2 | 3973,2 |
| 513 | 1850,4 | 1930,4 | 3700,8 | 3860,8 | 607 | 1869,2 | 1949,2 | 3738,4 | 3898,4 | 701 | 1888,0 | 1968,0 | 3776,0 | 3936,0 | 795 | 1906,8 | 1986,8 | 3813,6 | 3973,6 |
| 514 | 1850,6 | 1930,6 | 3701,2 | 3861,2 | 608 | 1869,4 | 1949,4 | 3738,8 | 3898,8 | 702 | 1888,2 | 1968,2 | 3776,4 | 3936,4 | 796 | 1907,0 | 1987,0 | 3814,0 | 3974,0 |
| 515 | 1850,8 | 1930,8 | 3701,6 | 3861,6 | 609 | 1869,6 | 1949,6 | 3739,2 | 3899,2 | 703 | 1888,4 | 1968,4 | 3776,8 | 3936,8 | 797 | 1907,2 | 1987,2 | 3814,4 | 3974,4 |
| 516 | 1851,0 | 1931,0 | 3702,0 | 3862,0 | 610 | 1869,8 | 1949,8 | 3739,6 | 3899,6 | 704 | 1888,6 | 1968,6 | 3777,2 | 3937,2 | 798 | 1907,4 | 1987,4 | 3814,8 | 3974,8 |
| 517 | 1851,2 | 1931,2 | 3702,4 | 3862,4 | 611 | 1870,0 | 1950,0 | 3740,0 | 3900,0 | 705 | 1888,8 | 1968,8 | 3777,6 | 3937,6 | 799 | 1907,6 | 1987,6 | 3815,2 | 3975,2 |
| 518 | 1851,4 | 1931,4 | 3702,8 | 3862,8 | 612 | 1870,2 | 1950,2 | 3740,4 | 3900,4 | 706 | 1889,0 | 1969,0 | 3778,0 | 3938,0 | 800 | 1907,8 | 1987,8 | 3815,6 | 3975,6 |
| 519 | 1851,6 | 1931,6 | 3703,2 | 3863,2 | 613 | 1870,4 | 1950,4 | 3740,8 | 3900,8 | 707 | 1889,2 | 1969,2 | 3778,4 | 3938,4 | 801 | 1908,0 | 1988,0 | 3816,0 | 3976,0 |
| 520 | 1851,8 | 1931,8 | 3703,6 | 3863,6 | 614 | 1870,6 | 1950,6 | 3741,2 | 3901,2 | 708 | 1889,4 | 1969,4 | 3778,8 | 3938,8 | 802 | 1908,2 | 1988,2 | 3816,4 | 3976,4 |
| 521 | 1852,0 | 1932,0 | 3704,0 | 3864,0 | 615 | 1870,8 | 1950,8 | 3741,6 | 3901,6 | 709 | 1889,6 | 1969,6 | 3779,2 | 3939,2 | 803 | 1908,4 | 1988,4 | 3816,8 | 3976,8 |
| 522 | 1852,2 | 1932,2 | 3704,4 | 3864,4 | 616 | 1871,0 | 1951,0 | 3742,0 | 3902,0 | 710 | 1889,8 | 1969,8 | 3779,6 | 3939,6 | 804 | 1908,6 | 1988,6 | 3817,2 | 3977,2 |
| 523 | 1852,4 | 1932,4 | 3704,8 | 3864,8 | 617 | 1871,2 | 1951,2 | 3742,4 | 3902,4 | 711 | 1890,0 | 1970,0 | 3780,0 | 3940,0 | 805 | 1908,8 | 1988,8 | 3817,6 | 3977,6 |
| 524 | 1852,6 | 1932,6 | 3705,2 | 3865,2 | 618 | 1871,4 | 1951,4 | 3742,8 | 3902,8 | 712 | 1890,2 | 1970,2 | 3780,4 | 3940,4 | 806 | 1909,0 | 1989,0 | 3818,0 | 3978,0 |
| 525 | 1852,8 | 1932,8 | 3705,6 | 3865,6 | 619 | 1871,6 | 1951,6 | 3743,2 | 3903,2 | 713 | 1890,4 | 1970,4 | 3780,8 | 3940,8 | 807 | 1909,2 | 1989,2 | 3818,4 | 3978,4 |
| 526 | 1853,0 | 1933,0 | 3706,0 | 3866,0 | 620 | 1871,8 | 1951,8 | 3743,6 | 3903,6 | 714 | 1890,6 | 1970,6 | 3781,2 | 3941,2 | 808 | 1909,4 | 1989,4 | 3818,8 | 3978,8 |
| 527 | 1853,2 | 1933,2 | 3706,4 | 3866,4 | 621 | 1872,0 | 1952,0 | 3744,0 | 3904,0 | 715 | 1890,8 | 1970,8 | 3781,6 | 3941,6 | 809 | 1909,6 | 1989,6 | 3819,2 | 3979,2 |
| 528 | 1853,4 | 1933,4 | 3706,8 | 3866,8 | 622 | 1872,2 | 1952,2 | 3744,4 | 3904,4 | 716 | 1891,0 | 1971,0 | 3782,0 | 3942,0 | 810 | 1909,8 | 1989,8 | 3819,6 | 3979,6 |
| 529 | 1853,6 | 1933,6 | 3707,2 | 3867,2 | 623 | 1872,4 | 1952,4 | 3744,8 | 3904,8 | 717 | 1891,2 | 1971,2 | 3782,4 | 3942,4 | | | | | |
| 530 | 1853,8 | 1933,8 | 3707,6 | 3867,6 | 624 | 1872,6 | 1952,6 | 3745,2 | 3905,2 | 718 | 1891,4 | 1971,4 | 3782,8 | 3942,8 | | | | | |
| 531 | 1854,0 | 1934,0 | 3708,0 | 3868,0 | 625 | 1872,8 | 1952,8 | 3745,6 | 3905,6 | 719 | 1891,6 | 1971,6 | 3783,2 | 3943,2 | | | | | |
| 532 | 1854,2 | 1934,2 | 3708,4 | 3868,4 | 626 | 1873,0 | 1953,0 | 3746,0 | 3906,0 | 720 | 1891,8 | 1971,8 | 3783,6 | 3943,6 | | | | | |
| 533 | 1854,4 | 1934,4 | 3708,8 | 3868,8 | 627 | 1873,2 | 1953,2 | 3746,4 | 3906,4 | 721 | 1892,0 | 1972,0 | 3784,0 | 3944,0 | | | | | |
| 534 | 1854,6 | 1934,6 | 3709,2 | 3869,2 | 628 | 1873,4 | 1953,4 | 3746,8 | 3906,8 | 722 | 1892,2 | 1972,2 | 3784,4 | 3944,4 | | | | | |
| 535 | 1854,8 | 1934,8 | 3709,6 | 3869,6 | 629 | 1873,6 | 1953,6 | 3747,2 | 3907,2 | 723 | 1892,4 | 1972,4 | 3784,8 | 3944,8 | | | | | |
| 536 | 1855,0 | 1935,0 | 3710,0 | 3870,0 | 630 | 1873,8 | 1953,8 | 3747,6 | 3907,6 | 724 | 1892,6 | 1972,6 | 3785,2 | 3945,2 | | | | | |
| 537 | 1855,2 | 1935,2 | 3710,4 | 3870,4 | 631 | 1874,0 | 1954,0 | 3748,0 | 3908,0 | 725 | 1892,8 | 1972,8 | 3785,6 | 3945,6 | | | | | |
| 538 | 1855,4 | 1935,4 | 3710,8 | 3870,8 | 632 | 1874,2 | 1954,2 | 3748,4 | 3908,4 | 726 | 1893,0 | 1973,0 | 3786,0 | 3946,0 | | | | | |
| 539 | 1855,6 | 1935,6 | 3711,2 | 3871,2 | 633 | 1874,4 | 1954,4 | 3748,8 | 3908,8 | 727 | 1893,2 | 1973,2 | 3786,4 | 3946,4 | | | | | |
| 540 | 1855,8 | 1935,8 | 3711,6 | 3871,6 | 634 | 1874,6 | 1954,6 | 3749,2 | 3909,2 | 728 | 1893,4 | 1973,4 | 3786,8 | 3946,8 | | | | | |
| 541 | 1856,0 | 1936,0 | 3712,0 | 3872,0 | 635 | 1874,8 | 1954,8 | 3749,6 | 3909,6 | 729 | 1893,6 | 1973,6 | 3787,2 | 3947,2 | | | | | |
| 542 | 1856,2 | 1936,2 | 3712,4 | 3872,4 | 636 | 1875,0 | 1955,0 | 3750,0 | 3910,0 | 730 | 1893,8 | 1973,8 | 3787,6 | 3947,6 | | | | | |
| 543 | 1856,4 | 1936,4 | 3712,8 | 3872,8 | 637 | 1875,2 | 1955,2 | 3750,4 | 3910,4 | 731 | 1894,0 | 1974,0 | 3788,0 | 3948,0 | | | | | |
| 544 | 1856,6 | 1936,6 | 3713,2 | 3873,2 | 638 | 1875,4 | 1955,4 | 3750,8 | 3910,8 | 732 | 1894,2 | 1974,2 | 3788,4 | 3948,4 | | | | | |
| 545 | 1856,8 | 1936,8 | 3713,6 | 3873,6 | 639 | 1875,6 | 1955,6 | 3751,2 | 3911,2 | 733 | 1894,4 | 1974,4 | 3788,8 | 3948,8 | | | | | |
| 546 | 1857,0 | 1937,0 | 3714,0 | 3874,0 | 640 | 1875,8 | 1955,8 | 3751,6 | 3911,6 | 734 | 1894,6 | 1974,6 | 3789,2 | 3949,2 | | | | | |
| 547 | 1857,2 | 1937,2 | 3714,4 | 3874,4 | 641 | 1876,0 | 1956,0 | 3752,0 | 3912,0 | 735 | 1894,8 | 1974,8 | 3789,6 | 3949,6 | | | | | |
| 548 | 1857,4 | 1937,4 | 3714,8 | 3874,8 | 642 | 1876,2 | 1956,2 | 3752,4 | 3912,4 | 736 | 1895,0 | 1975,0 | 3790,0 | 3950,0 | | | | | |
| 549 | 1857,6 | 1937,6 | 3715,2 | 3875,2 | 643 | 1876,4 | 1956,4 | 3752,8 | 3912,8 | 737 | 1895,2 | 1975,2 | 3790,4 | 3950,4 | | | | | |
| 550 | 1857,8 | 1937,8 | 3715,6 | 3875,6 | 644 | 1876,6 | 1956,6 | 3753,2 | 3913,2 | 738 | 1895,4 | 1975,4 | 3790,8 | 3950,8 | | | | | |
| 551 | 1858,0 | 1938,0 | 3716,0 | 3876,0 | 645 | 1876,8 | 1956,8 | 3753,6 | 3913,6 | 739 | 1895,6 | 1975,6 | 3791,2 | 3951,2 | | | | | |
| 552 | 1858,2 | 1938,2 | 3716,4 | 3876,4 | 646 | 1877,0 | 1957,0 | 3754,0 | 3914,0 | 740 | 1895,8 | 1975,8 | 3791,6 | 3951,6 | | | | | |
| 553 | 1858,4 | 1938,4 | 3716,8 | 3876,8 | 647 | 1877,2 | 1957,2 | 3754,4 | 3914,4 | 741 | 1896,0 | 1976,0 | 3792,0 | 3952,0 | | | | | |
| 554 | 1858,6 | 1938,6 | 3717,2 | 3877,2 | 648 | 1877,4 | 1957,4 | 3754,8 | 3914,8 | 742 | 1896,2 | 1976,2 | 3792,4 | 3952,4 | | | | | |
| 555 | 1858,8 | 1938,8 | 3717,6 | 3877,6 | 649 | 1877,6 | 1957,6 | 3755,2 | 3915,2 | 743 | 1896,4 | 1976,4 | 3792,8 | 3952,8 | | | | | |
| 556 | 1859,0 | 1939,0 | 3718,0 | 3878,0 | 650 | 1877,8 | 1957,8 | 3755,6 | 3915,6 | 744 | 1896,6 | 1976,6 | 3793,2 | 3953,2 | | | | | |
| 557 | 1859,2 | 1939,2 | 3718,4 | 3878,4 | 651 | 1878,0 | 1958,0 | 3756,0 | 3916,0 | 745 | 1896,8 | 1976,8 | 3793,6 | 3953,6 | | | | | |
| 558 | 1859,4 | 1939,4 | 3718,8 | 3878,8 | 652 | 1878,2 | 1958,2 | 3756,4 | 3916,4 | 746 | 1897,0 | 1977,0 | 3794,0 | 3954,0 | | | | | |
| 559 | 1859,6 | 1939,6 | 3719,2 | 3879,2 | 653 | 1878,4 | 1958,4 | 3756,8 | 3916,8 | 747 | 1897,2 | 1977,2 | 3794,4 | 3954,4 | | | | | |
| 560 | 1859,8 | 1939,8 | 3719,6 | 3879,6 | 654 | 1878,6 | 1958,6 | 3757,2 | 3917,2 | 748 | 1897,4 | 1977,4 | 3794,8 | 3954,8 | | | | | |
| 561 | 1860,0 | 1940,0 | 3720,0 | 3880,0 | 655 | 1878,8 | 1958,8 | 3757,6 | 3917,6 | 749 | 1897,6 | 1977,6 | 3795,2 | 3955,2 | | | | | |
| 562 | 1860,2 | 1940,2 | 3720,4 | 3880,4 | 656 | 1879,0 | 1959,0 | 3758,0 | 3918,0 | 750 | 1897,8 | 1977,8 | 3795,6 | 3955,6 | | | | | |
| 563 | 1860,4 | 1940,4 | 3720,8 | 3880,8 | 657 | 1879,2 | 1959,2 | 3758,4 | 3918,4 | 751 | 1898,0 | 1978,0 | 3796,0 | 3956,0 | | | | | |
| 564 | 1860,6 | 1940,6 | 3721,2 | 3881,2 | 658 | 1879,4 | 1959,4 | 3758,8 | 3918,8 | 752 | 1898,2 | 1978,2 | 3796,4 | 3956,4 | | | | | |
| 565 | 1860,8 | 1940,8 | 3721,6 | 3881,6 | 659 | 1879,6 | 1959,6 | 3759,2 | 3919,2 | 753 | 1898,4 | 1978,4 | 3796,8 | 3956,8 | | | | | |
| 566 | 1861,0 | 1941,0 | 3722,0 | 3882,0 | 660 | 1879,8 | 1959,8 | 3759,6 | 3919,6 | 754 | 1898,6 | 1978,6 | 3797,2 | 3957,2 | | | | | |
| 567 | 1861,2 | 1941,2 | 3722,4 | 3882,4 | 661 | 1880,0 | 1960,0 | 3760,0 | 3920,0 | 755 | 1898,8 | 1978,8 | 3797,6 | 3957,6 | | | | | |
| 568 | 1861,4 | 1941,4 | 3722,8 | 3882,8 | 662 | 1880,2 | 1960,2 | 3760,4 | 3920,4 | 756 | 1899,0 | 1979,0 | 3798,0 | 3958,0 | | | | | |
| 569 | 1861,6 | 1941,6 | 3723,2 | 3883,2 | 663 | 1880,4 | 1960,4 | 3760,8 | 3920,8 | 757 | 1899,2 | 1979,2 | 3798,4 | 3958,4 | | | | | |
| 570 | 1861,8 | 1941,8 | 3723,6 | 3883,6 | 664 | 1880,6 | 1960,6 | 3761,2 | 3921,2 | 758 | 1899,4 | 1979,4 | 3798,8 | 3958,8 | | | | | |
| 571 | 1862,0 | 1942,0 | 3724,0 | 3884,0 | 665 | 1880,8 | 1960,8 | 3761,6 | 3921,6 | 759 | 1899,6 | 1979,6 | 3799,2 | 3959,2 | | | | | |
| 572 | 1862,2 | 1942,2 | 3724,4 | 3884,4 | 666 | 1881,0 | 1961,0 | 3762,0 | 3922,0 | 760 | 1899,8 | 1979,8 | 3799,6 | 3959,6 | | | | | |
| 573 | 1862,4 | 1942,4 | 3724,8 | 3884,8 | 667 | 1881,2 | 1961,2 | 3762,4 | 3922,4 | 761 | 1900,0 | 1980,0 | 3800,0 | 3960,0 | | | | | |
| 574 | 1862,6 | 1942,6 | 3725,2 | 3885,2 | 668 | 1881,4 | 1961,4 | 3762,8 | 3922,8 | 762 | 1900,2 | 1980,2 | 3800,4 | 3960,4 | | | | | |
| 575 | 1862,8 | 1942,8 | 3725,6 | 3885,6 | 669 | 1881,6 | 1961,6 | 3763,2 | 3923,2 | 763 | 1900,4 | 1980,4 | 3800,8 | 3960,8 | | | | | |
| 576 | 1863,0 | 1943,0 | 3726,0 | 3886,0 | 670 | 1881,8 | 1961,8 | 3763,6 | 3923,6 | 764 | 1900,6 | 1980,6 | 3801,2 | 3961,2 | | | | | |
| 577 | 1863,2 | 1943,2 | 3726,4 | 3886,4 | 671 | 1882,0 | 1962,0 | 3764,0 | 3924,0 | 765 | 1900,8 | 1980,8 | 3801,6 | 3961,6 | | | | | |
| 578 | 1863,4 | 1943,4 | 3726,8 | 3886,8 | 672 | 1882,2 | 1962,2 | 3764,4 | 3924,4 | 766 | 1901,0 | 1981,0 | 3802,0 | 3962,0 | | | | | |
| 579 | 1863,6 | 1943,6 | 3727,2 | 3887,2 | 673 | 1882,4 | 1962,4 | 3764,8 | 3924,8 | 767 | 1901,2 | 1981,2 | 3802,4 | 3962,4 | | | | | |
| 580 | 1863,8 | 1943,8 | 3727,6 | 3887,6 | 674 | 1882,6 | 1962,6 | 3765,2 | 3925,2 | 768 | 1901,4 | 1981,4 | 3802,8 | 3962,8 | | | | | |
| 581 | 1864,0 | 1944,0 | 3728,0 | 3888,0 | 675 | 1882,8 | 1962,8 | 3765,6 | 3925,6 | 769 | 1901,6 | 1981,6 | 3803,2 | 3963,2 | | | | | |
| 582 | 1864,2 | 1944,2 | 3728,4 | 3888,4 | 676 | 1883,0 | 1963,0 | 3766,0 | 3926,0 | 770 | 1901,8 | 1981,8 | 3803,6 | 3963,6 | | | | | |
| 583 | 1864,4 | 1944,4 | 3728,8 | 3888,8 | 677 | 1883,2 | 1963,2 | 3766,4 | 3926,4 | 771 | 1902,0 | 1982,0 | 3804,0 | 3964,0 | | | | | |
| 584 | 1864,6 | 1944,6 | 3729,2 | 3889,2 | 678 | 1883,4 | 1963,4 | 3766,8 | 3926,8 | 772 | 1902,2 | 1982,2 | 3804,4 | 3964,4 | | | | | |
| 585 | 1864,8 | 1944,8 | 3729,6 | 3889,6 | 679 | 1883,6 | 1963,6 | 3767,2 | 3927,2 | 773 | 1902,4 | 1982,4 | 3804,8 | 3964,8 | | | | | |
| 586 | 1865,0 | 1945,0 | 3730,0 | 3890,0 | 680 | 1883,8 | 1963,8 | 3767,6 | 3927,6 | 774 | 1902,6 | 1982,6 | 3805,2 | 3965,2 | | | | | |
| 587 | 1865,2 | 1945,2 | 3730,4 | 3890,4 | 681 | 1884,0 | 1964,0 | 3768,0 | 3928,0 | 775 | 1902,8 | 1982,8 | 3805,6 | 3965,6 | | | | | |
| 588 | 1865,4 | 1945,4 | 3730,8 | 3890,8 | 682 | 1884,2 | 1964,2 | 3768,4 | 3928,4 | 776 | 1903,0 | 1983,0 | 3806,0 | 3966,0 | | | | | |
| 589 | 1865,6 | 1945,6 | 3731,2 | 3891,2 | 683 | 1884,4 | 1964,4 | 3768,8 | 3928,8 | 777 | 1903,2 | 1983,2 | 3806,4 | 3966,4 | | | | | |
| 590 | 1865,8 | 1945,8 | 3731,6 | 3891,6 | 684 | 1884,6 | 1964,6 | 3769,2 | 3929,2 | 778 | 1903,4 | 1983,4 | 3806,8 | 3966,8 | | | | | |
| 591 | 1866,0 | 1946,0 | 3732,0 | 3892,0 | 685 | 1884,8 | 1964,8 | 3769,6 | 3929,6 | 779 | 1903,6 | 1983,6 | 3807,2 | 3967,2 | | | | | |
| 592 | 1866,2 | 1946,2 | 3732,4 | 3892,4 | 686 | 1885,0 | 1965,0 | 3770,0 | 3930,0 | 780 | 1903,8 | 1983,8 | 3807,6 | 3967,6 | | | | | |
| 593 | 1866,4 | 1946,4 | 3732,8 | 3892,8 | 687 | 1885,2 | 1965,2 | 3770,4 | 3930,4 | 781 | 1904,0 | 1984,0 | 3808,0 | 3968,0 | | | | | |
| 594 | 1866,6 | 1946,6 | 3733,2 | 3893,2 | 688 | 1885,4 | 1965,4 | 3770,8 | 3930,8 | 782 | 1904,2 | 1984,2 | 3808,4 | 3968,4 | | | | | |
| 595 | 1866,8 | 1946,8 | 3733,6 | 3893,6 | 689 | 1885,6 | 1965,6 | 3771,2 | 3931,2 | 783 | 1904,4 | 1984,4 | 3808,8 | 3968,8 | | | | | |
| 596 | 1867,0 | 1947,0 | 3734,0 | 3894,0 | 690 | 1885,8 | 1965,8 | 3771,6 | 3931,6 | 784 | 1904,6 | 1984,6 | 3809,2 | 3969,2 | | | | | |
| 597 | 1867,2 | 1947,2 | 3734,4 | 3894,4 | 691 | 1886,0 | 1966,0 | 3772,0 | 3932,0 | 785 | 1904,8 | 1984,8 | 3809,6 | 3969,6 | | | | | |
| 598 | 1867,4 | 1947,4 | 3734,8 | 3894,8 | 692 | 1886,2 | 1966,2 | 3772,4 | 3932,4 | 786 | 1905,0 | 1985,0 | 3810,0 | 3970,0 | | | | | |
| 599 | 1867,6 | 1947,6 | 3735,2 | 3895,2 | 693 | 1886,4 | 1966,4 | 3772,8 | 3932,8 | 787 | 1905,2 | 1985,2 | 3810,4 | 3970,4 | | | | | |
| 600 | 1867,8 | 1947,8 | 3735,6 | 3895,6 | 694 | 1886,6 | 1966,6 | 3773,2 | 3933,2 | 788 | 1905,4 | 1985,4 | 3810,8 | 3970,8 | | | | | |
| 601 | 1868,0 | 1948,0 | 3736,0 | 3896,0 | 695 | 1886,8 | 1966,8 | 3773,6 | 3933,6 | 789 | 1905,6 | 1985,6 | 3811,2 | 3971,2 | | | | | |
| 602 | 1868,2 | 1948,2 | 3736,4 | 3896,4 | 696 | 1887,0 | 1967,0 | 3774,0 | 3934,0 | 790 | 1905,8 | 1985,8 | 3811,6 | 3971,6 | | | | | |
| 603 | 1868,4 | 1948,4 | 3736,8 | 3896,8 | 697 | 1887,2 | 1967,2 | 3774,4 | 3934,4 | 791 | 1906,0 | 1986,0 | 3812,0 | 3972,0 | | | | | |
| 604 | 1868,6 | 1948,6 | 3737,2 | 3897,2 | 698 | 1887,4 | 1967,4 | 3774,8 | 3934,8 | 792 | 1906,2 | 1986,2 | 3812,4 | 3972,4 | | | | | |
| 605 | 1868,8 | 1948,8 | 3737,6 | 3897,6 | 699 | 1887,6 | 1967,6 | 3775,2 | 3935,2 | 793 | 1906,4 | 1986,4 | 3812,8 | 3972,8 | | | | | |


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# 9 — RM-178 schematics


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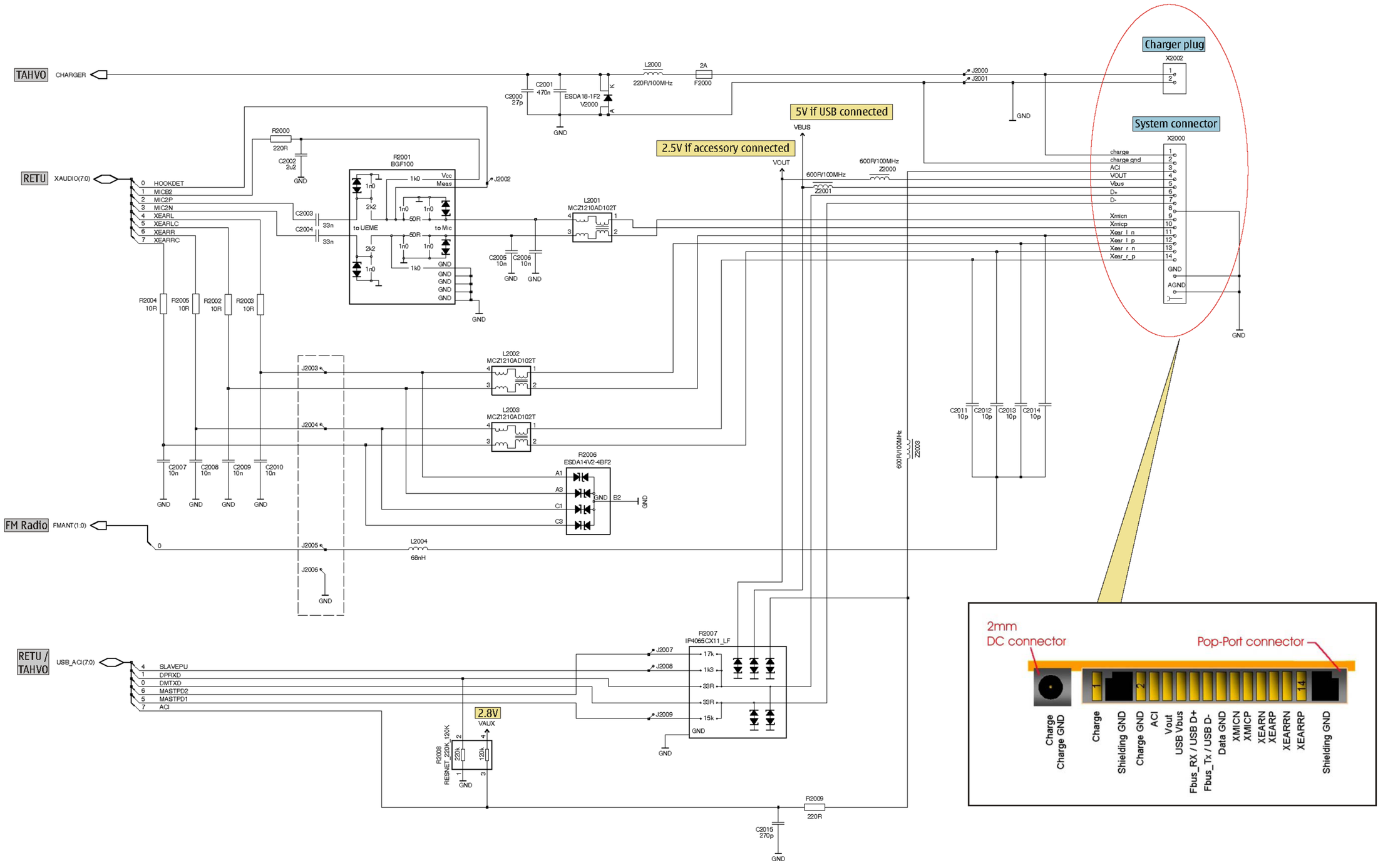
## RM-178 system connector





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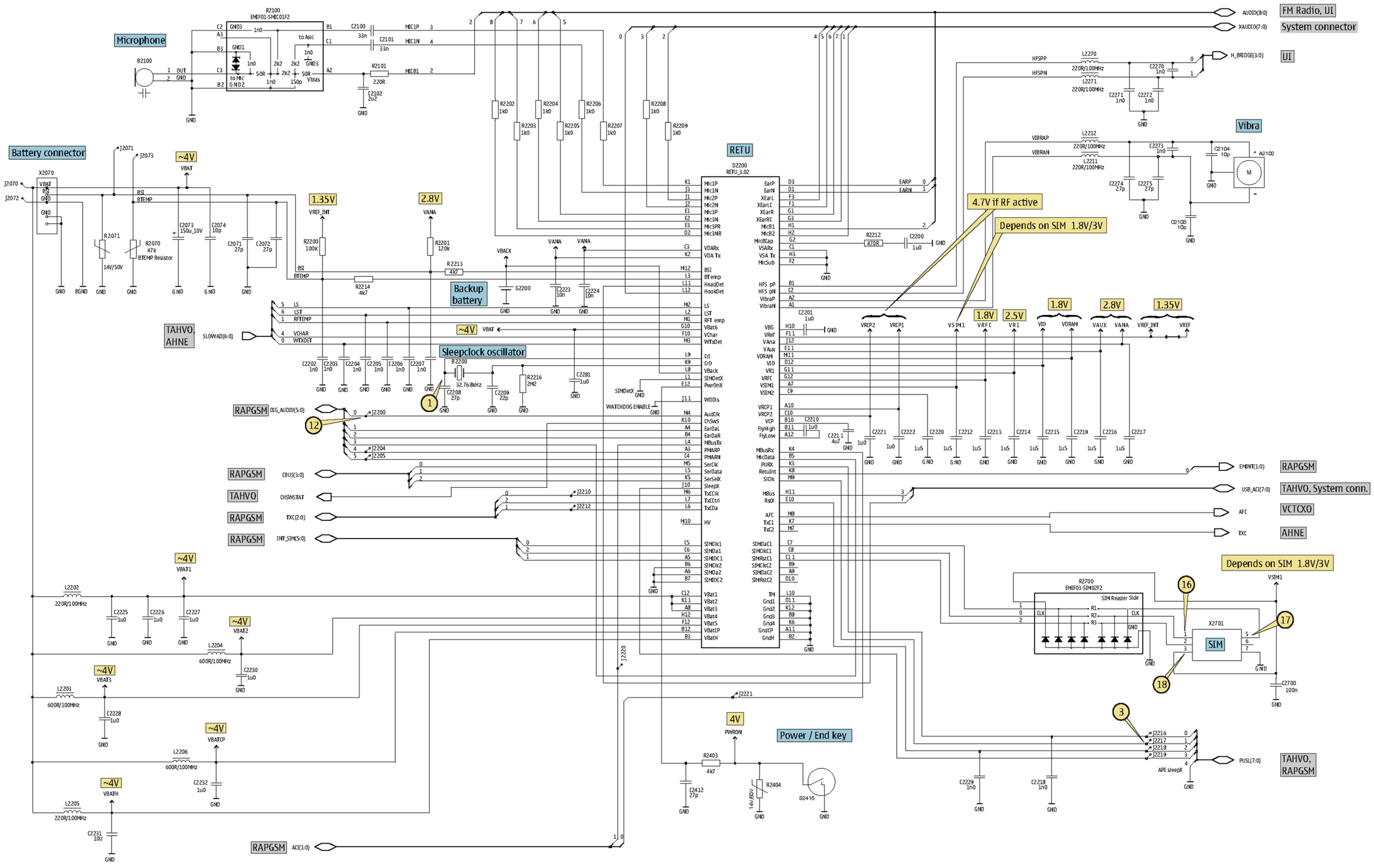
## RM-178 RETU





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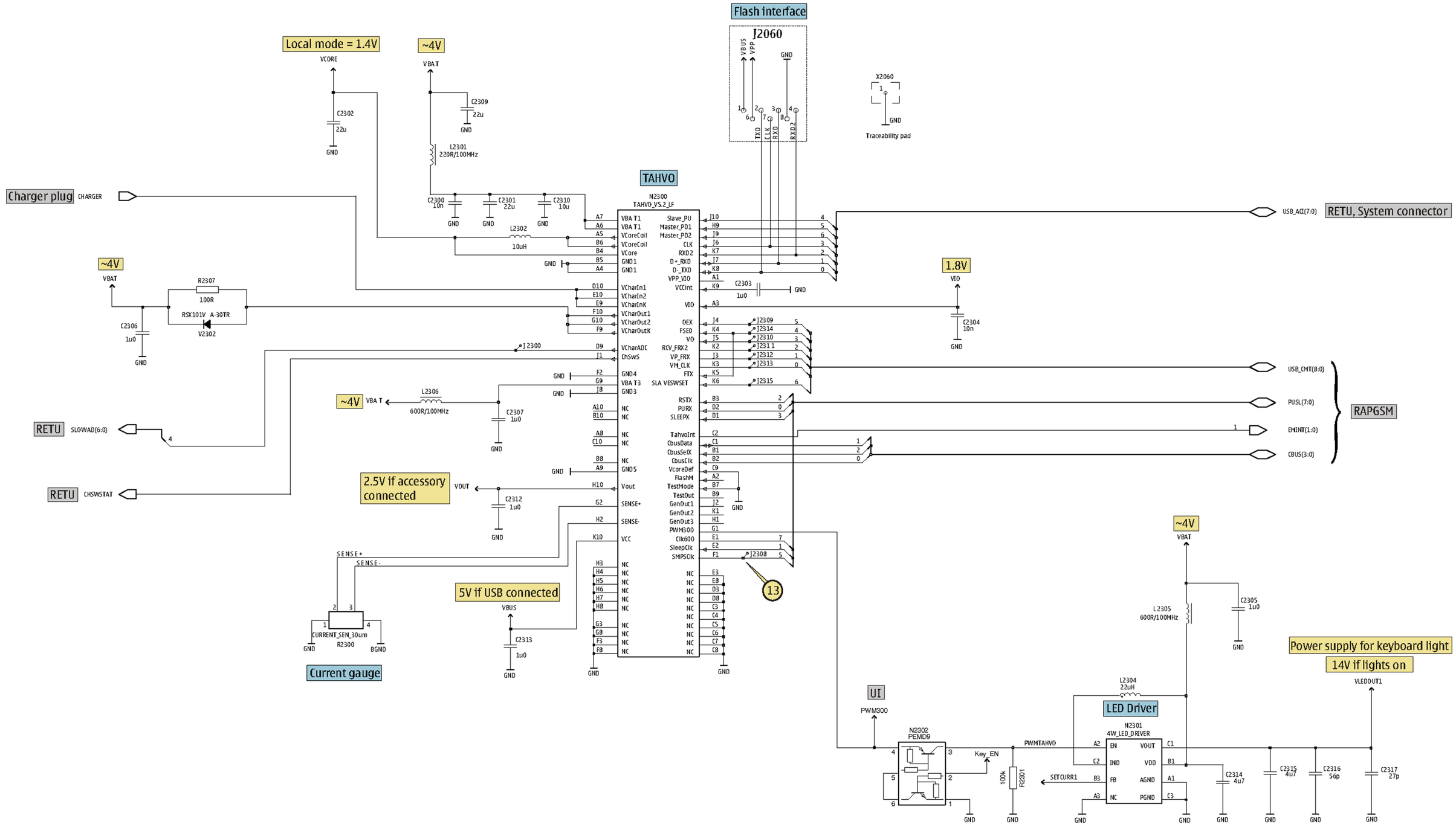
## RM-178 TAHVO





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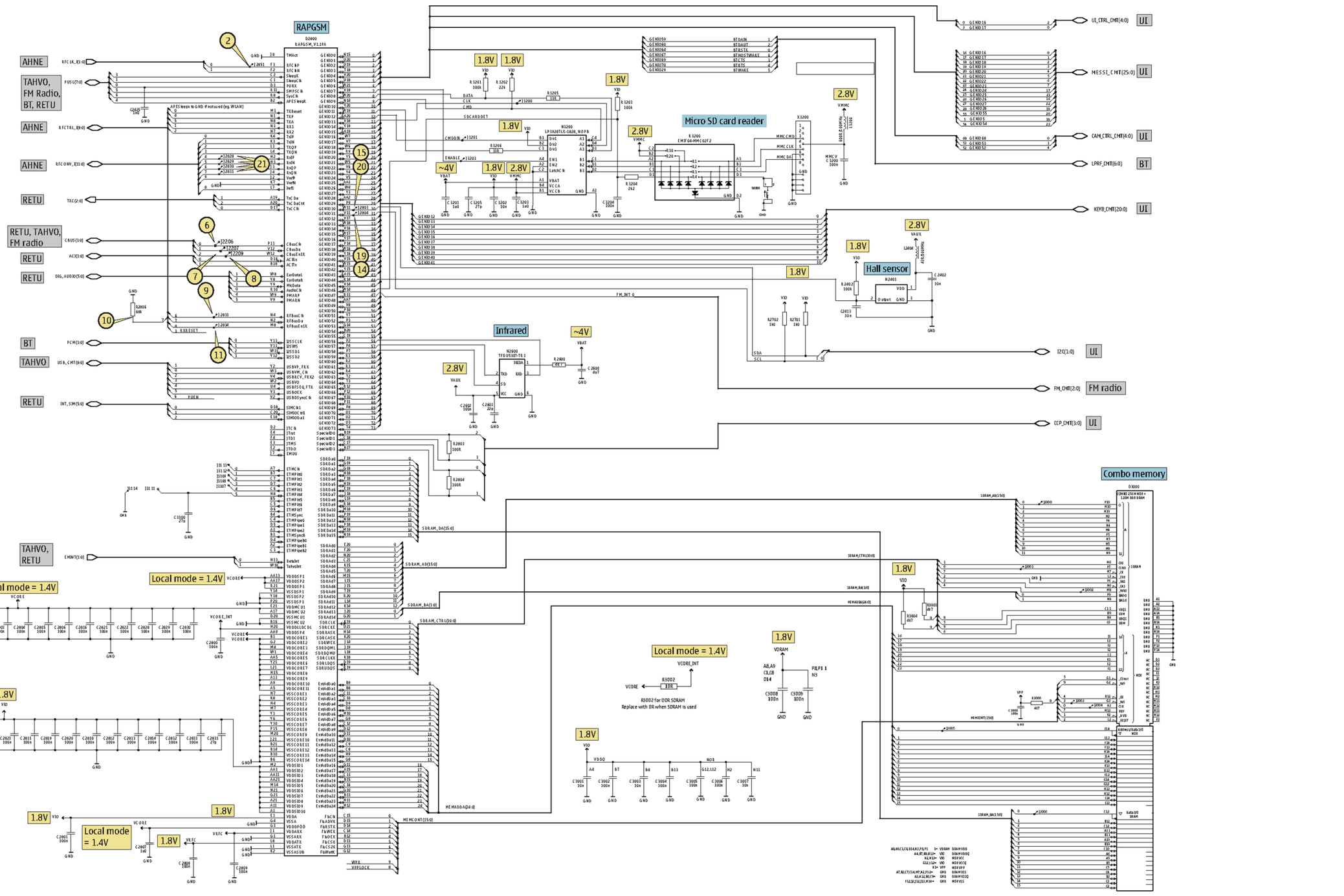
## RM-178 RAPGSM, Combo memory, MiniSD





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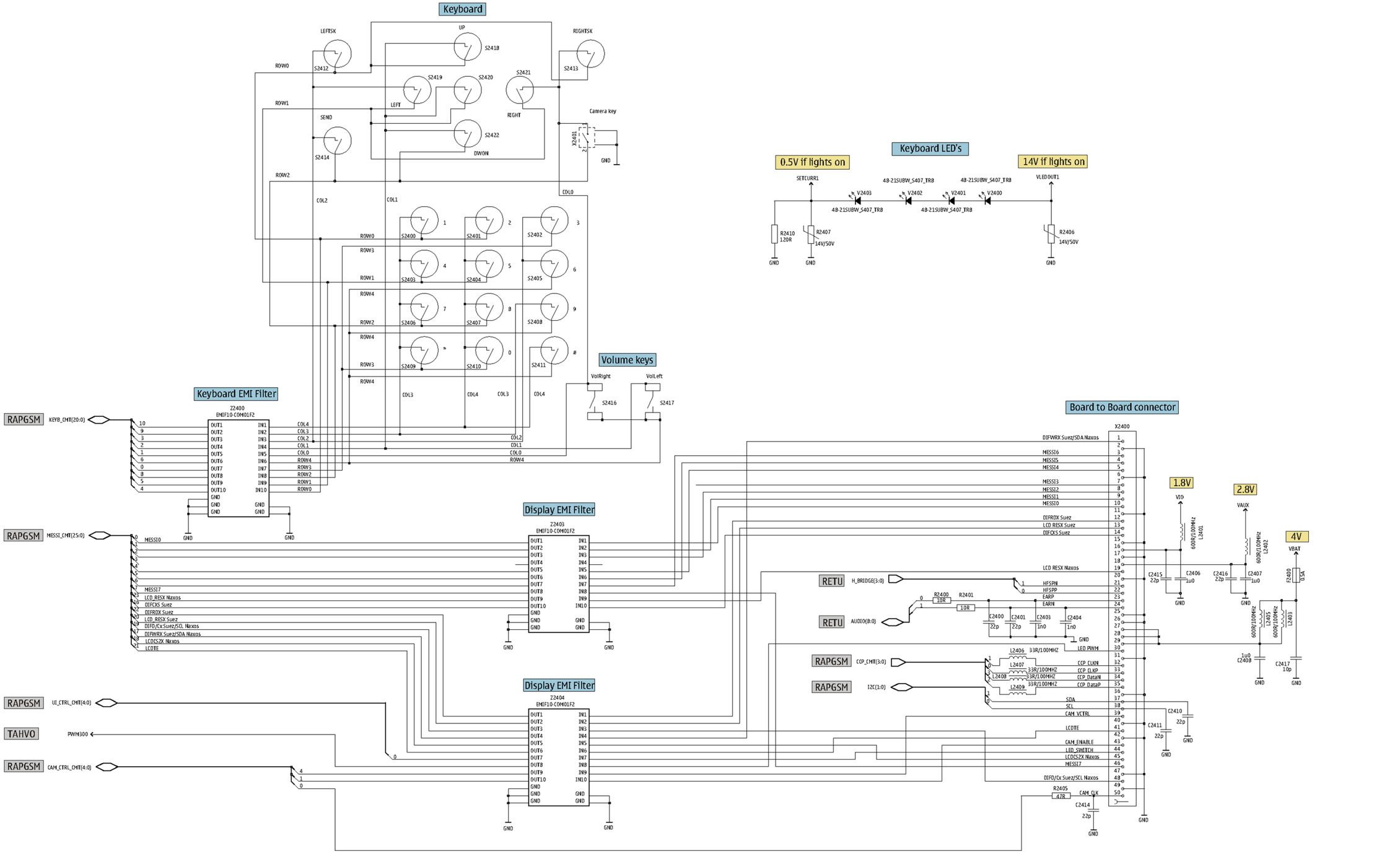
## RM-178 user interface





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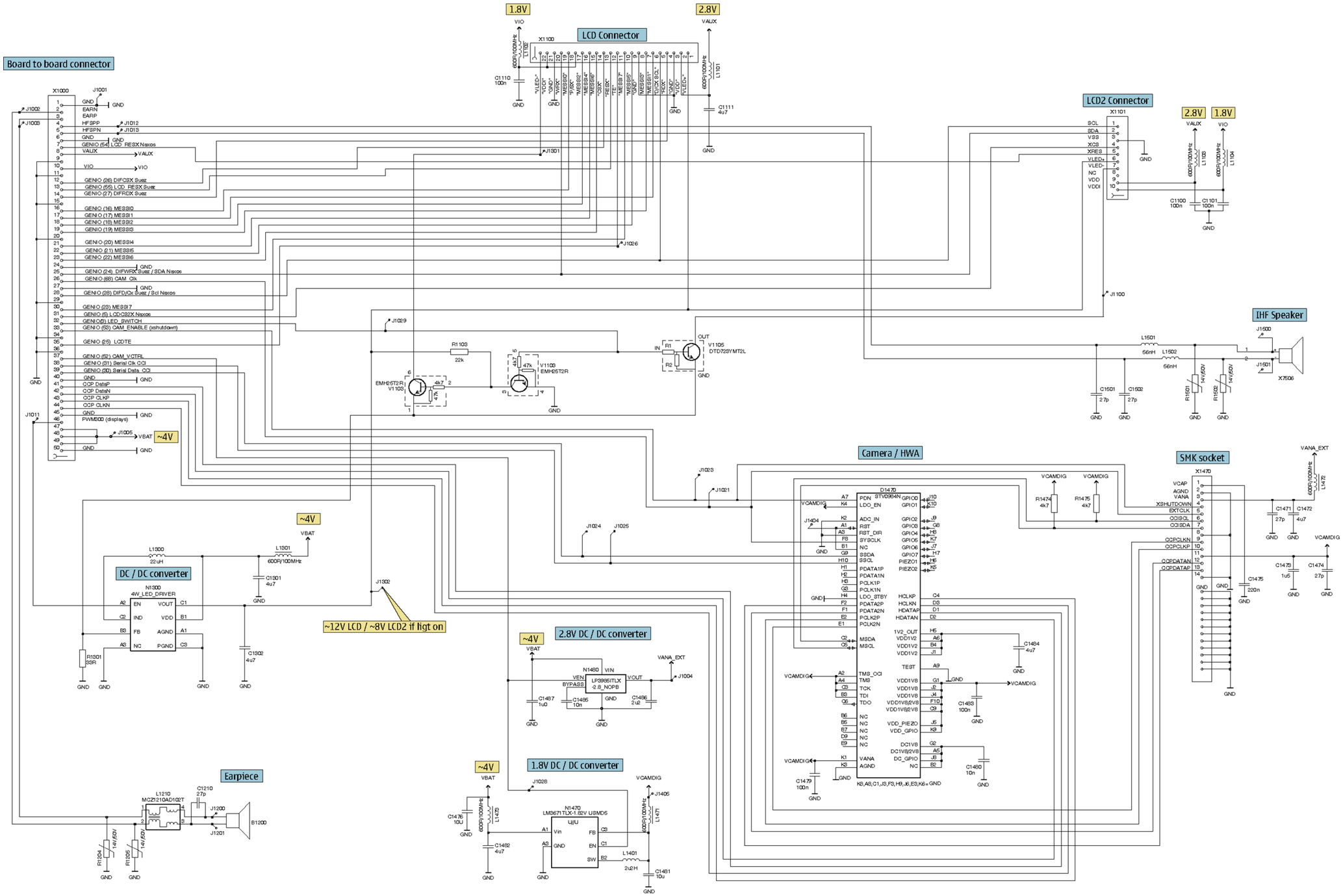
## RM-178 camera, earpiece, IHF speaker





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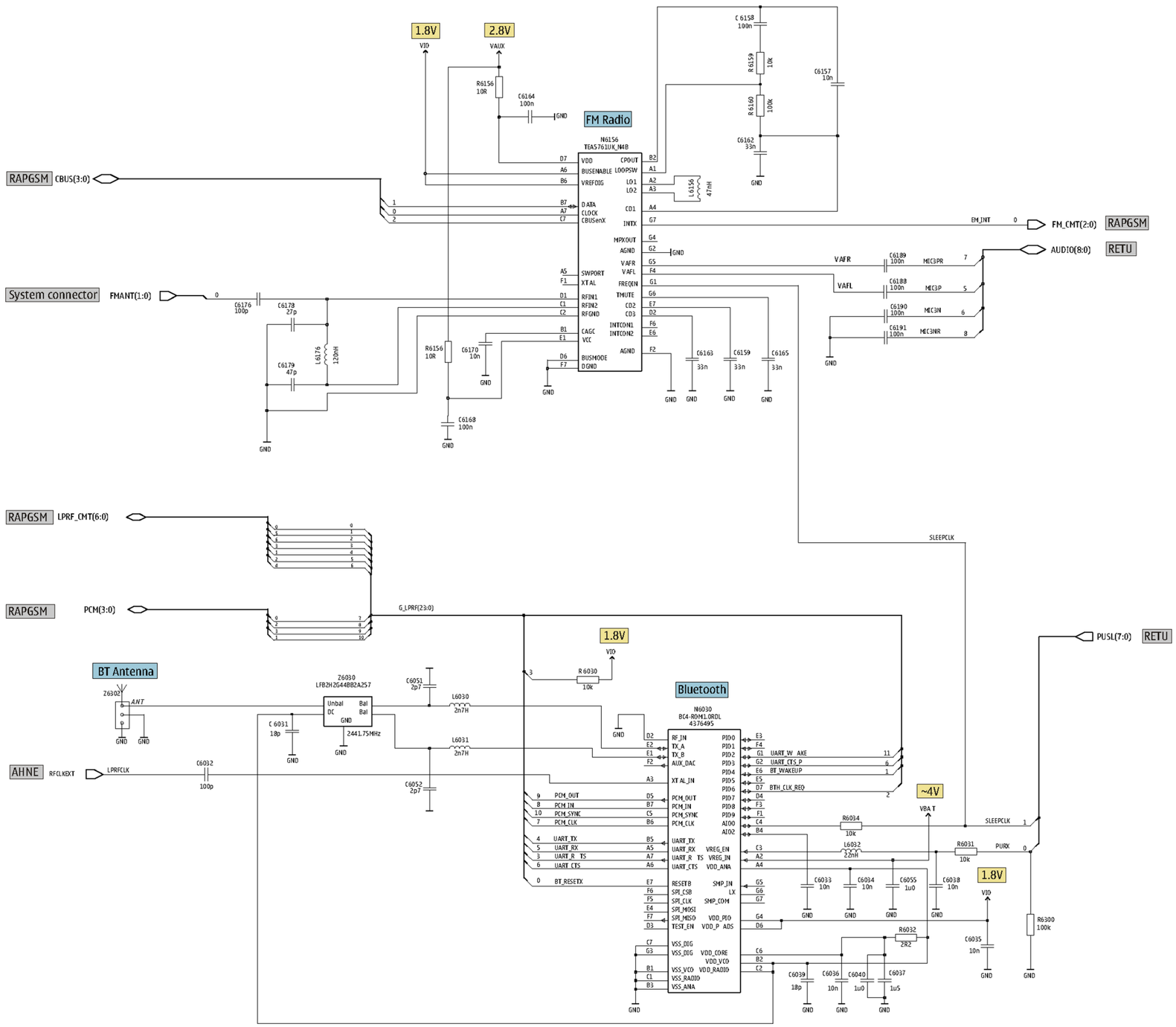
## RM-178 Bluetooth, FM radio





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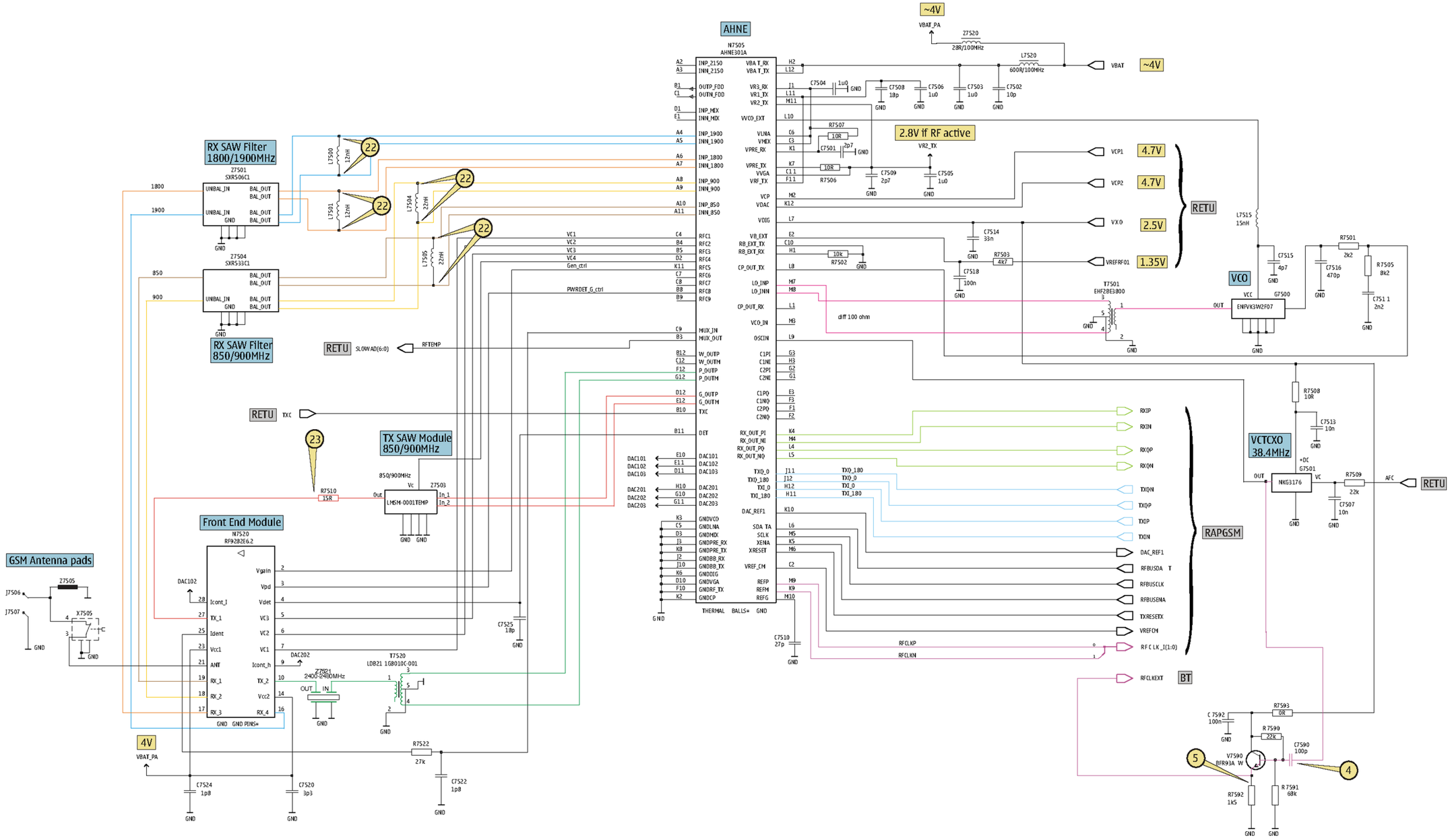
## RM-178 RF part

| Band | Channel | RX | VCO/RX | VC/RX | TX | VCO/TX | VC/TX |
|---|---|---|---|---|---|---|---|
| GSM 850 | 190 | 881.6MHz | 3526.4MHz | ~1.8V | 836.6MHz | 3346.4MHz | ~1.5V |
| GSM 900 | 37 | 942.4MHz | 3769.6MHz | ~2.73V | 897.4MHz | 3589.6MHz | ~1.99V |
| GSM 1800 | 700 | 1842.8MHz | 3685.6MHz | ~2.39V | 1747.8MHz | 3495.6MHz | ~1.60V |
| GSM 1900 | 661 | 1960.0MHz | 3920.0MHz | ~3.31V | 1880.0MHz | 3760.0MHz | ~2.96V |





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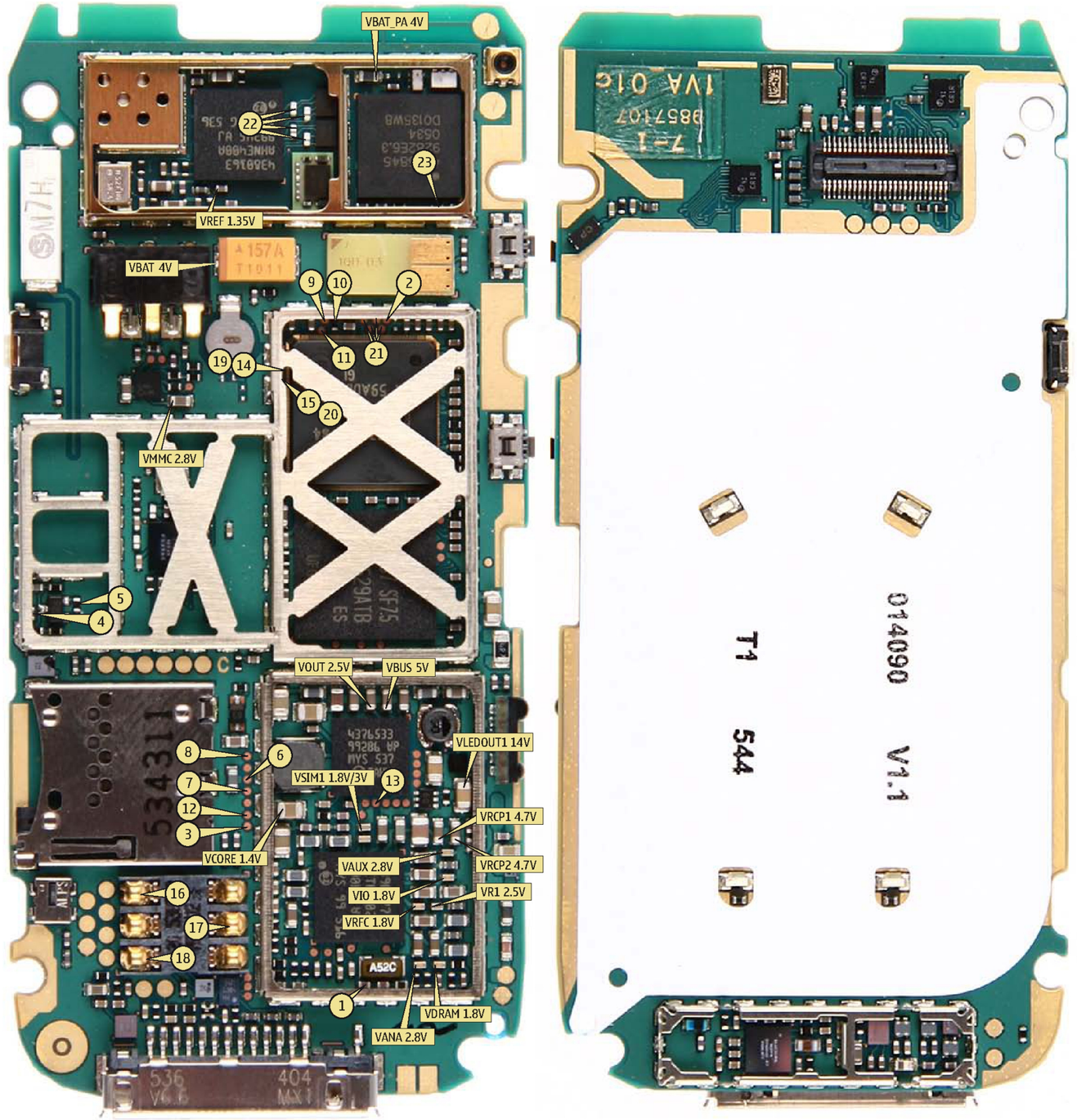
## RM-178 signal overview

| | | | |
|---|---|---|---|
| 1) 32 kHz at C2208 | 2) RFCLK at J2851 | 3) SleepCLK at J2217 | 4) VCTCXO 38.4 MHz at C7590 |
| 5) RFCLKEXT at R7592 | 6) CBUSCLK at J2206 | 7) CBUSDA at J2207 | 8) CBUSENX at J2209 |
| 9) RFBUSCLK at J2833 | 10) RFBUSDA at J2834 | 11) RFBUSENX at J2835 | 12) AUDIOCLK at J2200 |
| 13) SMPSCLK at J2308 | 14) FMSCL at J2804 | 15) FMSDA at J2803 | 16) SIMCLK at X2701 pin 1 |
| 17) SIMDA at X2701 pin 5 | 18) VSIM at X2701 pin 3 | 19) CAMERASCL at J2804 | 20) CAMERASDA at J2803 |
| 21) RXIQ GSM 900 at J2828-J2831 | 22) RX at L7500, L7501, L7504, L7505 | 23) TX at R7510 | |





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## RM-178 component finder

| B | | C2231 | N5 | C2815 | F7 | C6191 | Q5 | J2219 | N4 | L2404 | D7 | R2307 | L4 | V2000 | O8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B2100 | Q1 | C2232 | O7 | C2816 | I5 | C7501 | C4 | J2300 | N6 | L2405 | C5 | R2400 | O4 | V2302 | L4 |
| B2200 | P6 | C2270 | O5 | C2819 | I5 | C7502 | D4 | J2308 | N6 | L2406 | D5 | R2401 | O4 | V2400 | O6 |
| C | | C2271 | O5 | C2820 | F6 | C7503 | D3 | J2309 | M7 | L2407 | D5 | R2402 | D8 | V2401 | I6 |
| C2000 | N8 | C2272 | O5 | C2821 | I7 | C7504 | B4 | J2310 | M7 | L2408 | D5 | R2403 | N6 | V2402 | I3 |
| C2001 | N8 | C2273 | N6 | C2822 | F5 | C7505 | D3 | J2311 | N6 | L2409 | D5 | R2404 | G1 | V2403 | O3 |
| C2002 | R4 | C2274 | N6 | C2823 | I6 | C7506 | D3 | J2312 | M7 | L3200 | L2 | R2405 | F5 | V7590 | K1 |
| C2003 | R4 | C2275 | N5 | C2824 | J5 | C7507 | D3 | J2313 | N7 | L6030 | I3 | R2406 | O6 | X | |
| C2004 | R4 | C2281 | O8 | C2825 | F7 | C7508 | D3 | J2314 | N7 | L6031 | I3 | R2407 | O3 | X2000 | R4 |
| C2005 | R3 | C2300 | M5 | C2826 | I8 | C7509 | D3 | J2315 | M7 | L6032 | J3 | R2410 | Q1 | X2002 | R7 |
| C2006 | R3 | C2301 | L5 | C2828 | I7 | C7510 | D4 | J2803 | G5 | L6156 | R5 | R2600 | K8 | X2060 | B5 |
| C2007 | Q2 | C2302 | N5 | C2829 | G8 | C7511 | C3 | J2804 | G5 | L6176 | Q6 | R2700 | Q4 | X2070 | F3 |
| C2008 | Q3 | C2303 | L7 | C2830 | H5 | C7513 | D3 | J2828 | F6 | L7500 | C5 | R2701 | D3 | X2400 | D4 |
| C2009 | Q3 | C2304 | N6 | C2831 | I7 | C7515 | B3 | J2829 | F6 | L7501 | C5 | R2702 | D3 | X2401 | G1 |
| C2010 | Q3 | C2305 | L8 | C2832 | G8 | C7516 | C3 | J2830 | F6 | L7502 | D4 | R2803 | I8 | X2701 | P3 |
| C2011 | R3 | C2306 | M4 | C2833 | I6 | C7518 | D4 | J2831 | F6 | L7503 | D7 | R2804 | H8 | X3200 | M2 |
| C2012 | R3 | C2307 | L6 | C3000 | K5 | C7520 | C7 | J2833 | F6 | L7504 | C5 | R2806 | F6 | X7505 | B8 |
| C2013 | R3 | C2309 | L5 | C3001 | J5 | C7522 | D6 | J2834 | F6 | L7505 | C5 | R3000 | J5 | Z | |
| C2014 | R3 | C2310 | L6 | C3002 | K5 | C7523 | B7 | J2851 | F7 | L7515 | C3 | R3002 | H8 | Z2000 | Q5 |
| C2015 | Q4 | C2312 | L6 | C3003 | I8 | C7524 | D6 | J3000 | K6 | N | | R3003 | I8 | Z2001 | Q4 |
| C2071 | G3 | C2313 | L7 | C3004 | J8 | C7525 | D8 | J3001 | K6 | N2300 | M6 | R3004 | K7 | Z2003 | Q5 |
| C2072 | P2 | C2314 | M7 | C3005 | J8 | C7590 | K1 | J3002 | I5 | N2301 | M8 | R3200 | L1 | Z2400 | D6 |
| C2073 | E5 | C2315 | N8 | C3006 | K8 | C7592 | J1 | J3003 | K6 | N2302 | N7 | R3201 | G4 | Z2403 | B4 |
| C2074 | E2 | C2316 | N8 | C3007 | K8 | D | | J3004 | J7 | N2401 | E8 | R3202 | G3 | Z2404 | C3 |
| C2100 | Q2 | C2317 | N8 | C3008 | J8 | D2200 | O6 | J3005 | J7 | N2600 | M8 | R3203 | K5 | Z6030 | I3 |
| C2101 | Q2 | C2400 | N4 | C3009 | K8 | D2800 | H6 | J3006 | I7 | N3200 | G3 | R3204 | L4 | Z6302 | E1 |
| C2102 | Q2 | C2401 | N4 | C3200 | L2 | D3000 | J6 | J3112 | L4 | N6030 | J3 | R3205 | G3 | Z7501 | C6 |
| C2103 | E8 | C2402 | D8 | C3201 | G2 | F | | J3113 | L3 | N6156 | R5 | R3206 | G4 | Z7503 | D5 |
| C2104 | E8 | C2403 | C4 | C3202 | G3 | F2000 | P8 | J3114 | L3 | N7505 | C4 | R6030 | J4 | Z7504 | C6 |
| C2200 | O5 | C2404 | C5 | C3203 | H3 | F2400 | D5 | J3115 | L3 | N7520 | D7 | R6031 | I3 | Z7520 | B6 |
| C2201 | P7 | C2406 | C4 | C3204 | L4 | G | | J3116 | L2 | R | | R6032 | J3 | Z7521 | C7 |
| C2202 | P8 | C2407 | C4 | C3205 | G3 | G2200 | G4 | J3117 | L2 | R2000 | Q4 | R6034 | I4 | | |
| C2203 | P6 | C2408 | C5 | C6031 | I3 | G7500 | C3 | J3200 | G3 | R2001 | Q4 | R6156 | R5 | | |
| C2204 | P6 | C2410 | D4 | C6032 | J4 | G7501 | D2 | J3201 | G3 | R2002 | Q3 | R6157 | Q6 | | |
| C2205 | P5 | C2411 | D3 | C6033 | J4 | J | | J3203 | G3 | R2003 | Q3 | R6159 | Q5 | | |
| C2206 | P6 | C2412 | N6 | C6034 | J4 | J2000 | P8 | J7506 | B8 | R2004 | Q2 | R6160 | Q5 | | |
| C2207 | P7 | C2413 | D8 | C6035 | J3 | J2001 | Q8 | J7507 | C8 | R2005 | Q3 | R6300 | I3 | | |
| C2208 | Q6 | C2414 | F4 | C6036 | J3 | J2002 | P6 | L | | R2006 | Q3 | R7501 | C3 | | |
| C2209 | Q6 | C2415 | C3 | C6037 | J3 | J2003 | Q3 | L2000 | O8 | R2007 | Q4 | R7502 | B4 | | |
| C2210 | N7 | C2416 | C4 | C6038 | I3 | J2004 | Q3 | L2001 | Q3 | R2008 | Q4 | R7503 | D4 | | |
| C2211 | N7 | C2417 | D5 | C6039 | I4 | J2005 | R2 | L2002 | Q3 | R2009 | Q4 | R7505 | C3 | | |
| C2212 | N6 | C2600 | K8 | C6040 | J3 | J2006 | Q2 | L2003 | R3 | R2070 | P2 | R7506 | D3 | | |
| C2213 | O7 | C2601 | L8 | C6051 | I3 | J2007 | Q4 | L2004 | R3 | R2071 | G3 | R7507 | B4 | | |
| C2214 | O7 | C2602 | L8 | C6052 | I3 | J2008 | Q4 | L2202 | P8 | R2100 | Q2 | R7508 | D3 | | |
| C2215 | O7 | C2700 | Q3 | C6055 | J4 | J2009 | P4 | L2203 | O8 | R2101 | P2 | R7509 | D3 | | |
| C2216 | O7 | C2800 | H8 | C6157 | Q4 | J2060 | P2 | L2204 | P8 | R2200 | P8 | R7510 | D7 | | |
| C2217 | P7 | C2801 | F7 | C6158 | Q4 | J2070 | E3 | L2205 | P8 | R2201 | P7 | R7522 | D7 | | |
| C2218 | P6 | C2802 | H8 | C6159 | R6 | J2071 | E4 | L2206 | O7 | R2202 | P5 | R7523 | C7 | | |
| C2219 | P7 | C2803 | H8 | C6162 | R4 | J2072 | E4 | L2211 | N5 | R2203 | P5 | R7590 | K1 | | |
| C2220 | N6 | C2804 | F7 | C6163 | R6 | J2200 | N4 | L2212 | N6 | R2204 | P5 | R7591 | K1 | | |
| C2221 | N8 | C2805 | F7 | C6164 | R5 | J2204 | P5 | L2270 | O5 | R2205 | P5 | R7592 | K2 | | |
| C2222 | N7 | C2806 | F8 | C6165 | R6 | J2205 | P6 | L2271 | O5 | R2206 | P5 | R7593 | J1 | | |
| C2223 | O5 | C2807 | I5 | C6168 | Q6 | J2206 | M4 | L2301 | L5 | R2207 | P5 | S | | | |
| C2224 | P5 | C2808 | G8 | C6170 | Q5 | J2207 | N4 | L2302 | M5 | R2208 | P5 | S2416 | E8 | | |
| C2225 | P7 | C2809 | G8 | C6176 | R6 | J2209 | M4 | L2304 | M7 | R2209 | P5 | S2417 | H8 | | |
| C2226 | O7 | C2810 | I8 | C6178 | Q6 | J2210 | P6 | L2305 | L7 | R2212 | O5 | S3200 | O1 | | |
| C2227 | N6 | C2811 | F5 | C6179 | Q5 | J2212 | J8 | L2306 | M4 | R2213 | P7 | T | | | |
| C2228 | O7 | C2812 | H8 | C6188 | Q6 | J2216 | N6 | L2401 | C3 | R2214 | P8 | T7501 | C2 | | |
| C2229 | N6 | C2813 | F5 | C6189 | R6 | J2217 | N4 | L2402 | C4 | R2216 | Q7 | T7520 | C7 | | |
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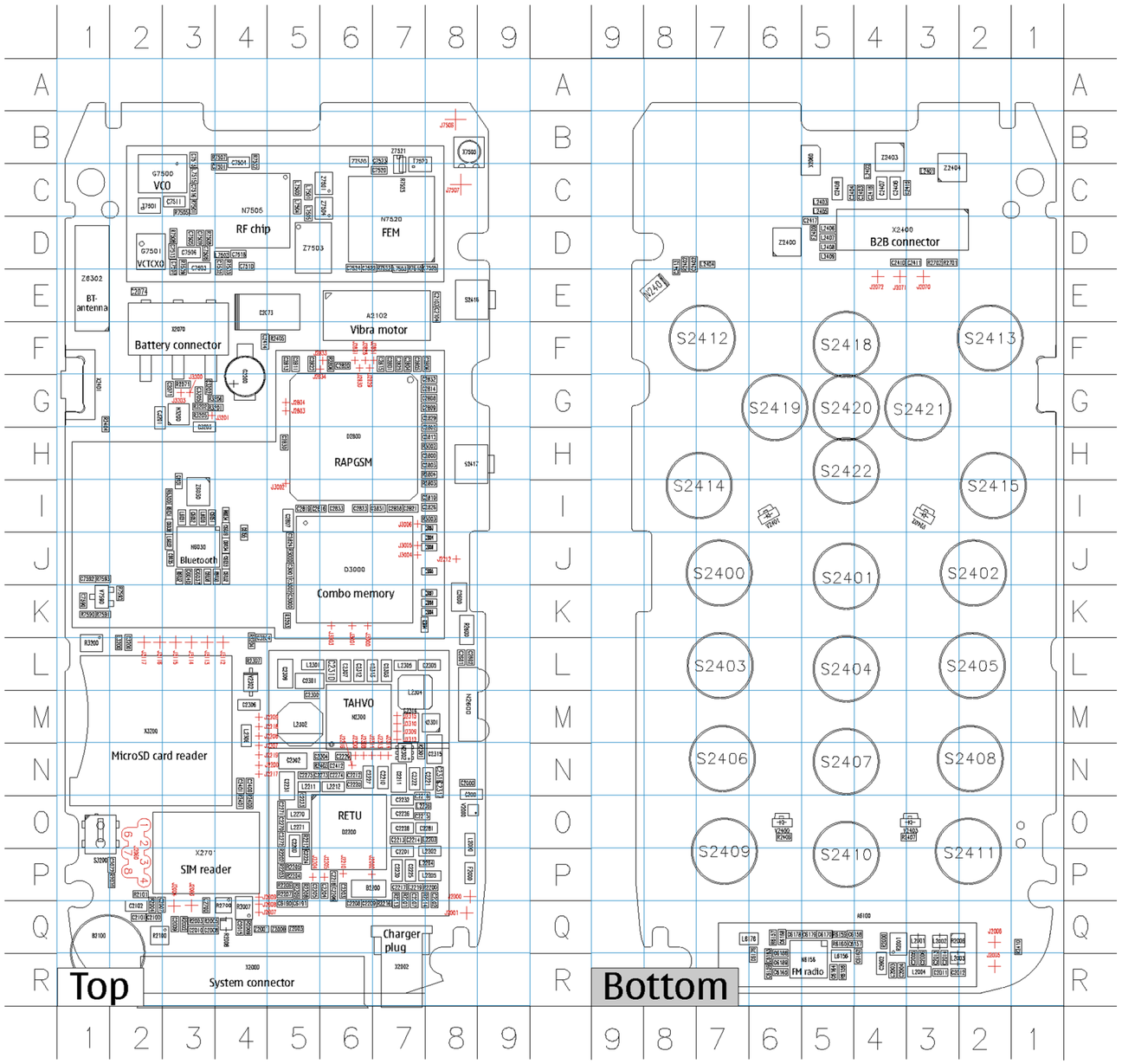



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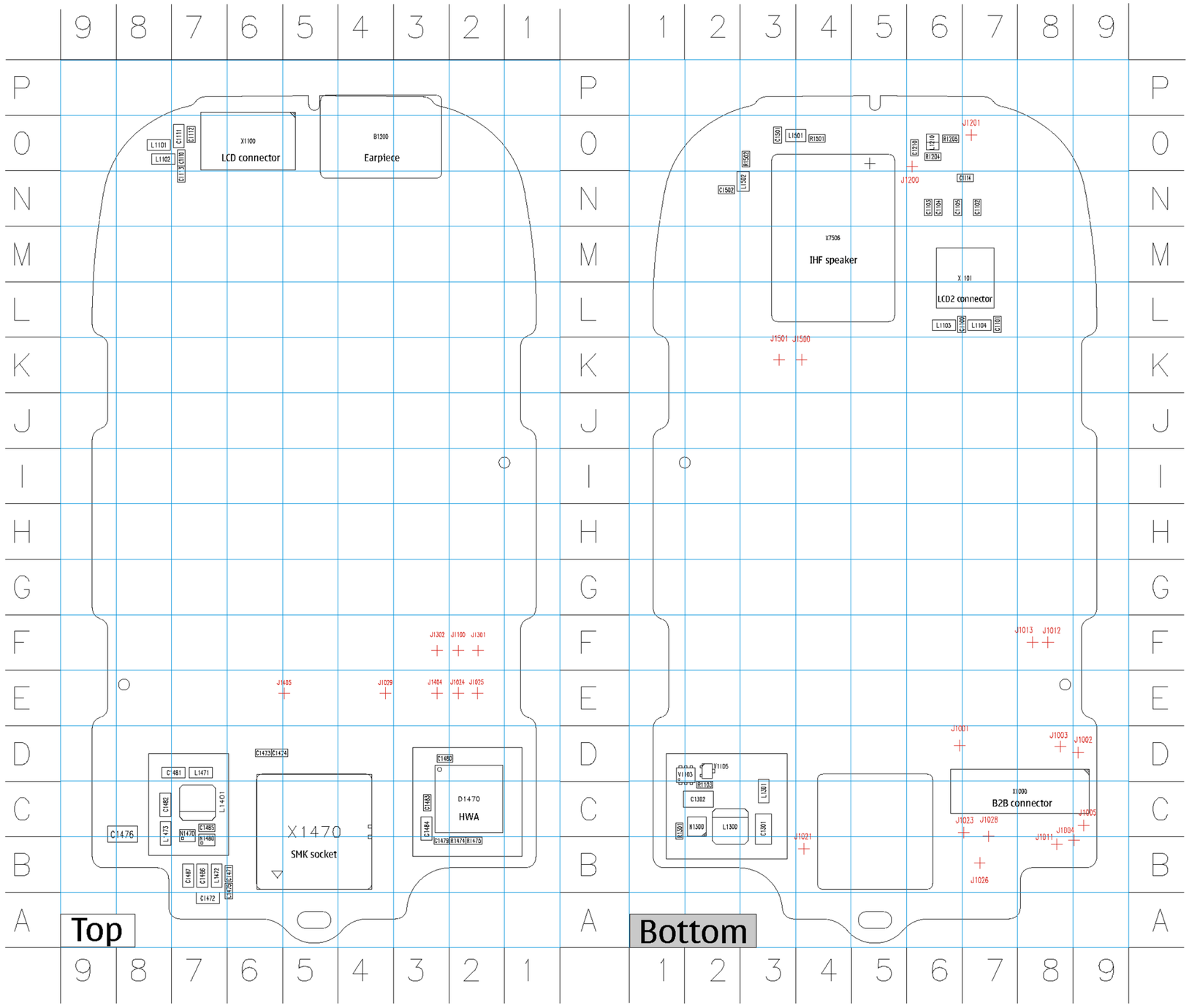
## RM-178 component finder user interface

| B | | J1026 | B7 |
|---|---|---|---|
| B1200 | O4 | J1028 | C7 |
| C | | J1029 | E4 |
| C1100 | L6 | J1100 | F2 |
| C1101 | L7 | J1200 | O6 |
| C1102 | N7 | J1201 | O7 |
| C1103 | N6 | J1301 | F2 |
| C1104 | N6 | J1302 | F3 |
| C1105 | N6 | J1404 | E3 |
| C1110 | O7 | J1405 | E5 |
| C1111 | O7 | J1500 | K4 |
| C1112 | O7 | J1501 | K3 |
| C1113 | N7 | L | |
| C1114 | N7 | L1101 | O8 |
| C1210 | O6 | L1102 | O8 |
| C1301 | C3 | L1103 | L6 |
| C1302 | C2 | L1104 | L7 |
| C1471 | B6 | L1210 | O6 |
| C1472 | A7 | L1300 | C2 |
| C1473 | D6 | L1301 | C3 |
| C1474 | D6 | L1401 | C7 |
| C1475 | B6 | L1471 | D7 |
| C1476 | C8 | L1472 | B7 |
| C1479 | B3 | L1473 | C8 |
| C1480 | D3 | L1501 | O4 |
| C1481 | D7 | L1502 | N3 |
| C1482 | C8 | N | |
| C1483 | C3 | N1300 | C2 |
| C1484 | C3 | N1470 | C7 |
| C1485 | C7 | N1480 | B7 |
| C1486 | B7 | R | |
| C1487 | B7 | R1103 | C2 |
| C1501 | O3 | R1204 | O6 |
| C1502 | N2 | R1205 | O6 |
| D | | R1301 | C1 |
| D1470 | C2 | R1474 | B2 |
| J | | R1475 | B2 |
| J1001 | D6 | R1501 | O4 |
| J1002 | D9 | R1502 | O3 |
| J1003 | D8 | V | |
| J1004 | B9 | V1103 | D2 |
| J1005 | C9 | V1105 | D2 |
| J1011 | B8 | X | |
| J1012 | F8 | X1000 | C8 |
| J1013 | F8 | X1100 | O6 |
| J1021 | B4 | X1101 | M7 |
| J1023 | C7 | X1470 | C5 |
| J1024 | E2 | X7506 | M4 |
| J1025 | E2 | | |





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# 10 — RM-106/199 schematics


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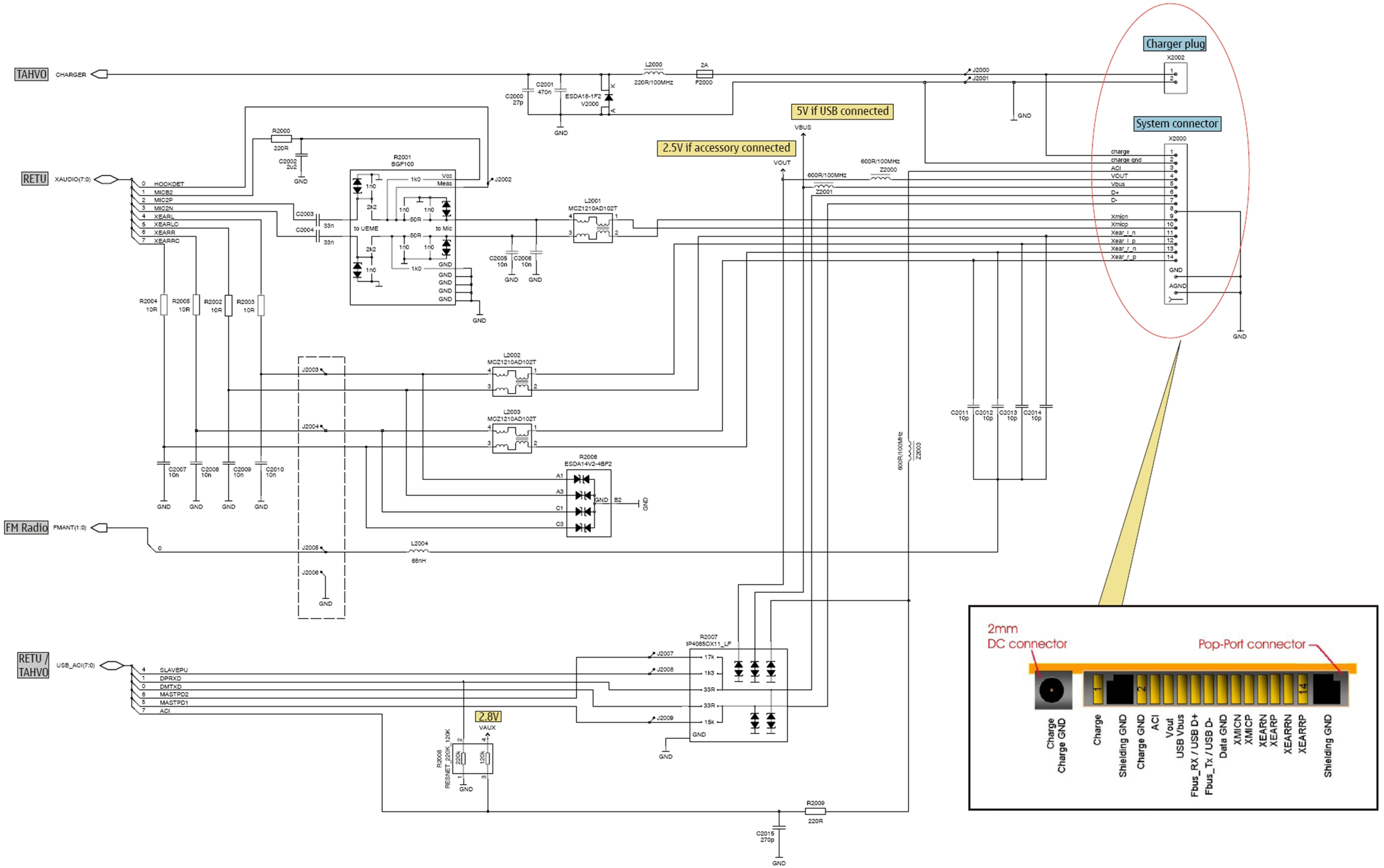
## RM-106/199 system connector





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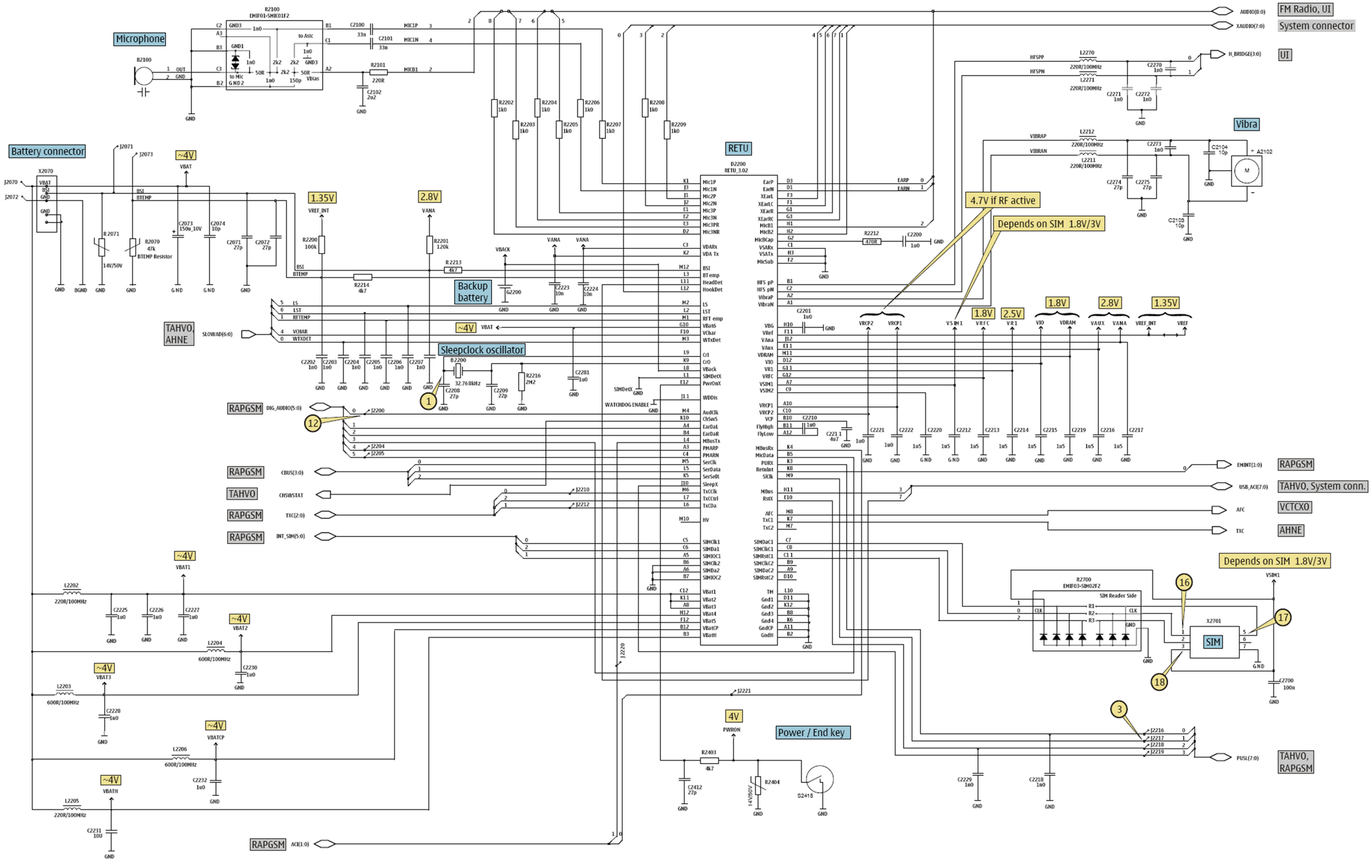
## RM-106/199 RETU





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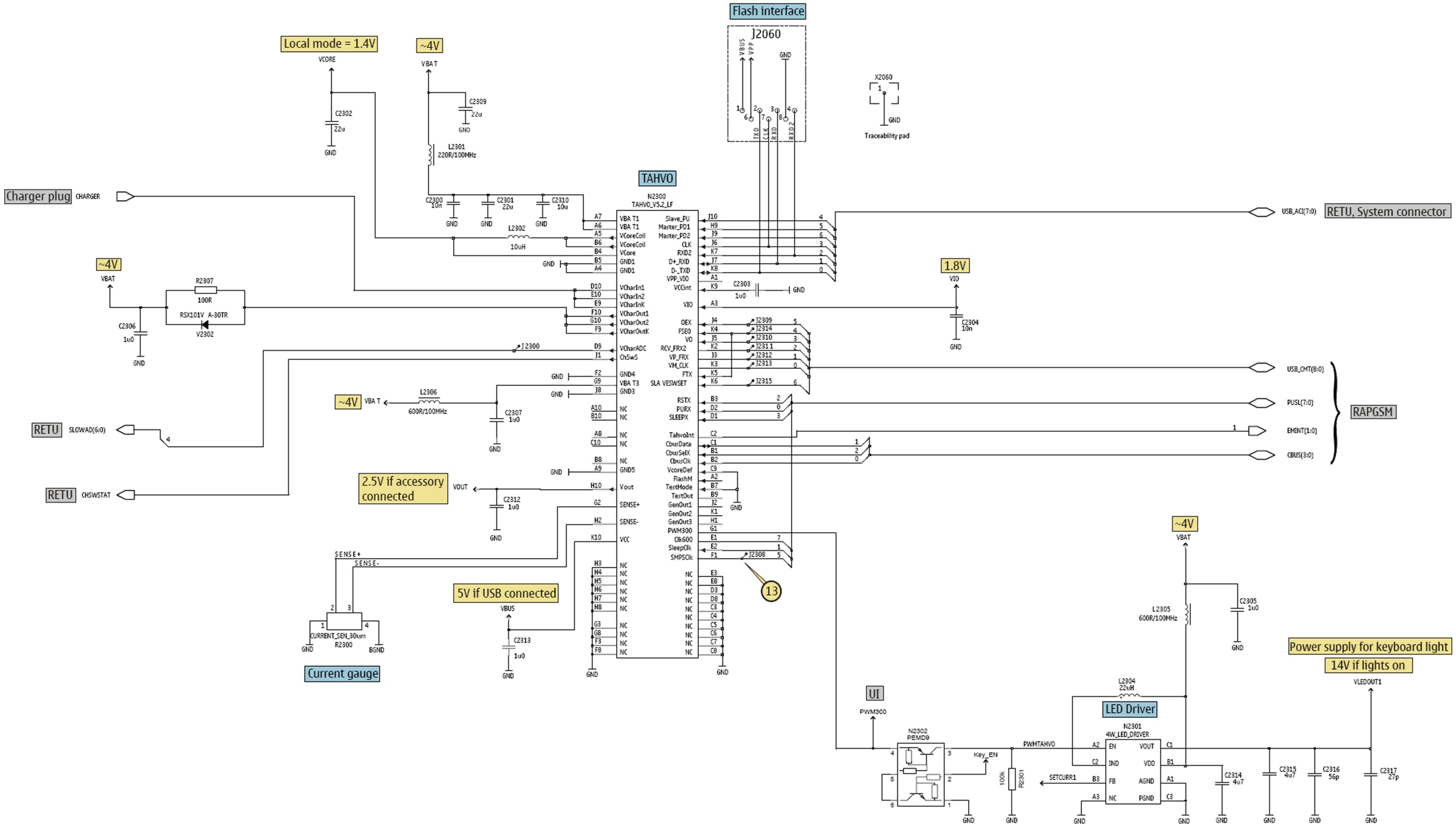
## RM-106/199 TAHVO





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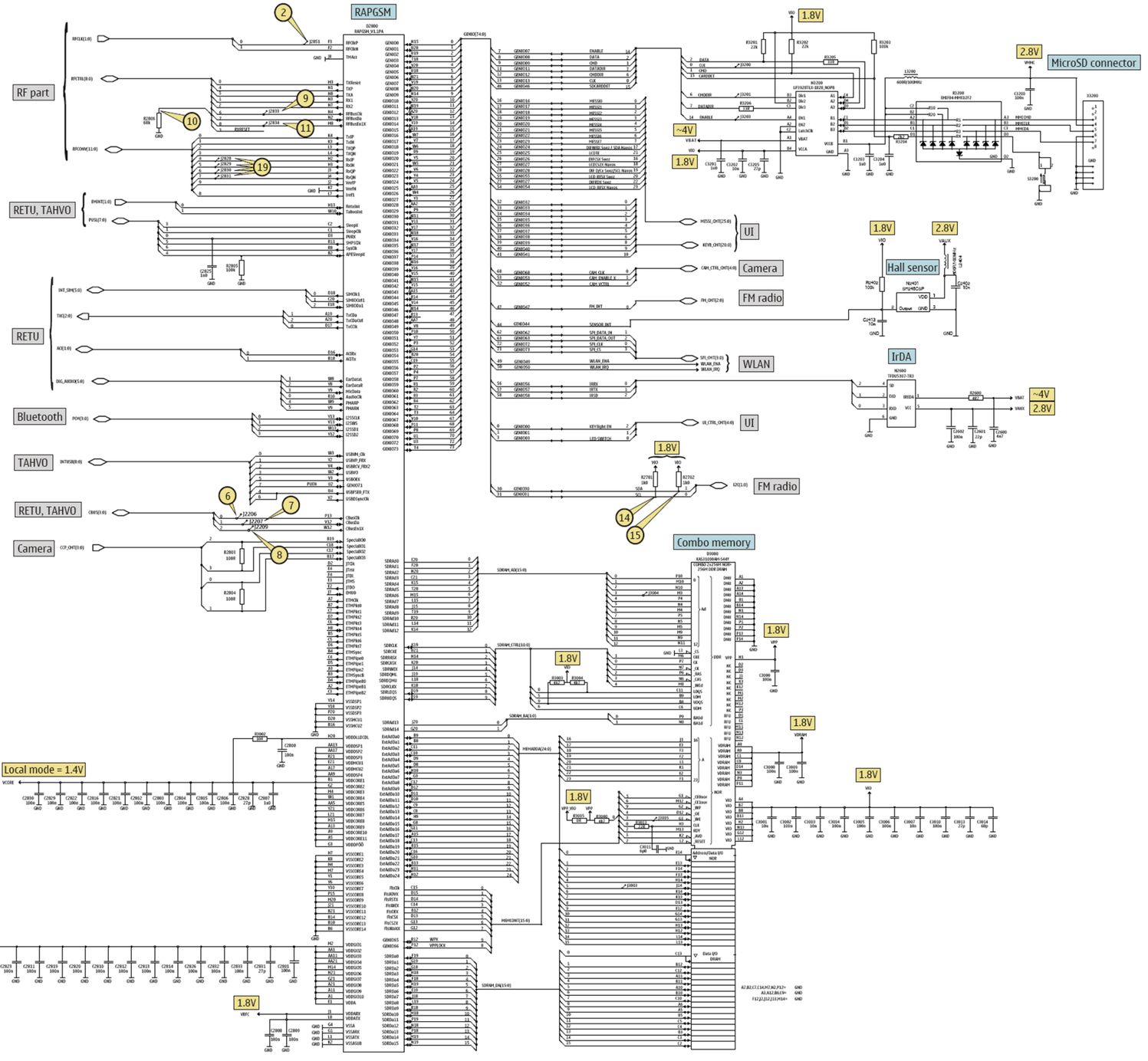
## RM-106/199 RAPGSM, Combo memory, IrDA, Micro SD





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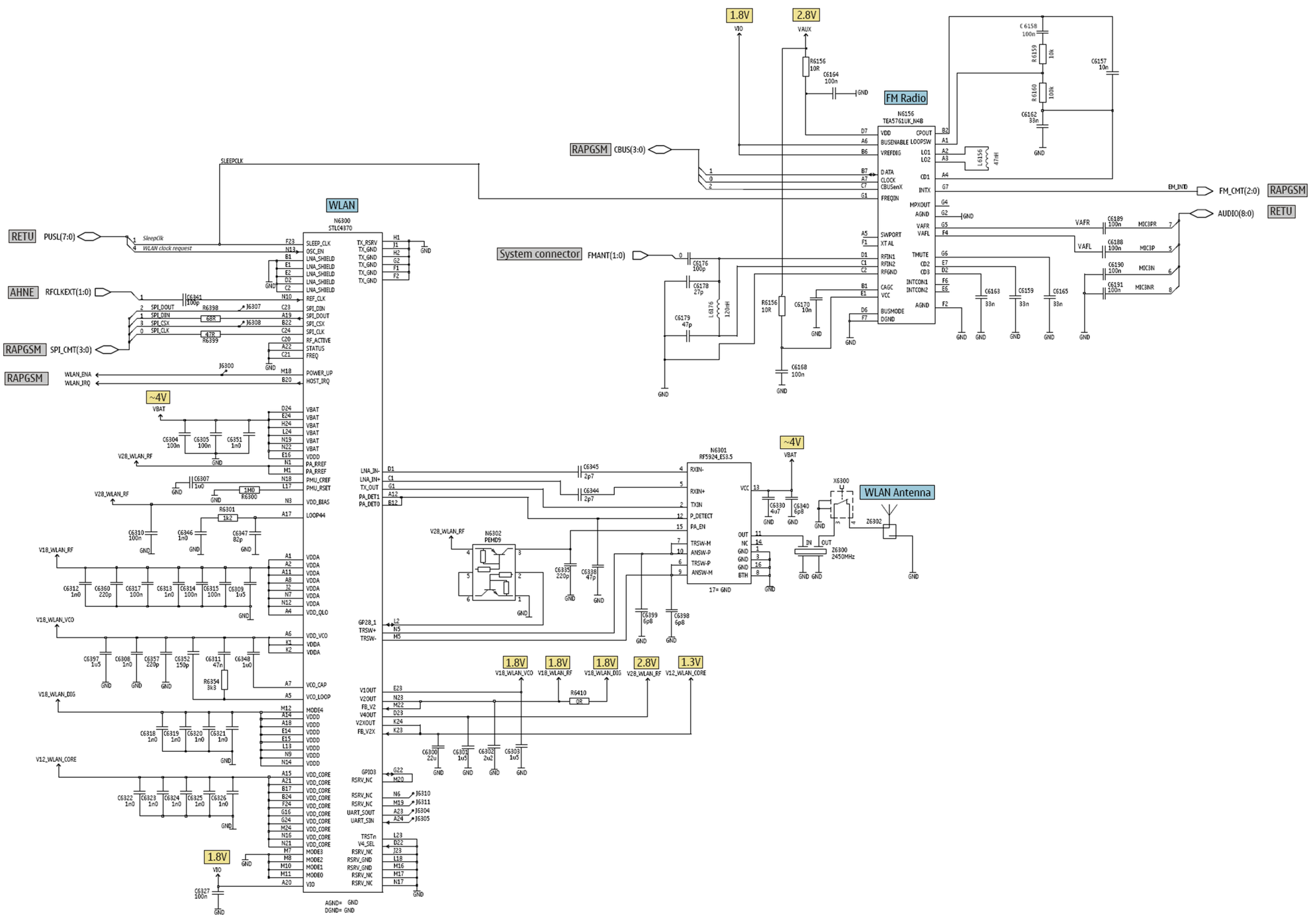
## RM-106/199 FM radio, WLAN





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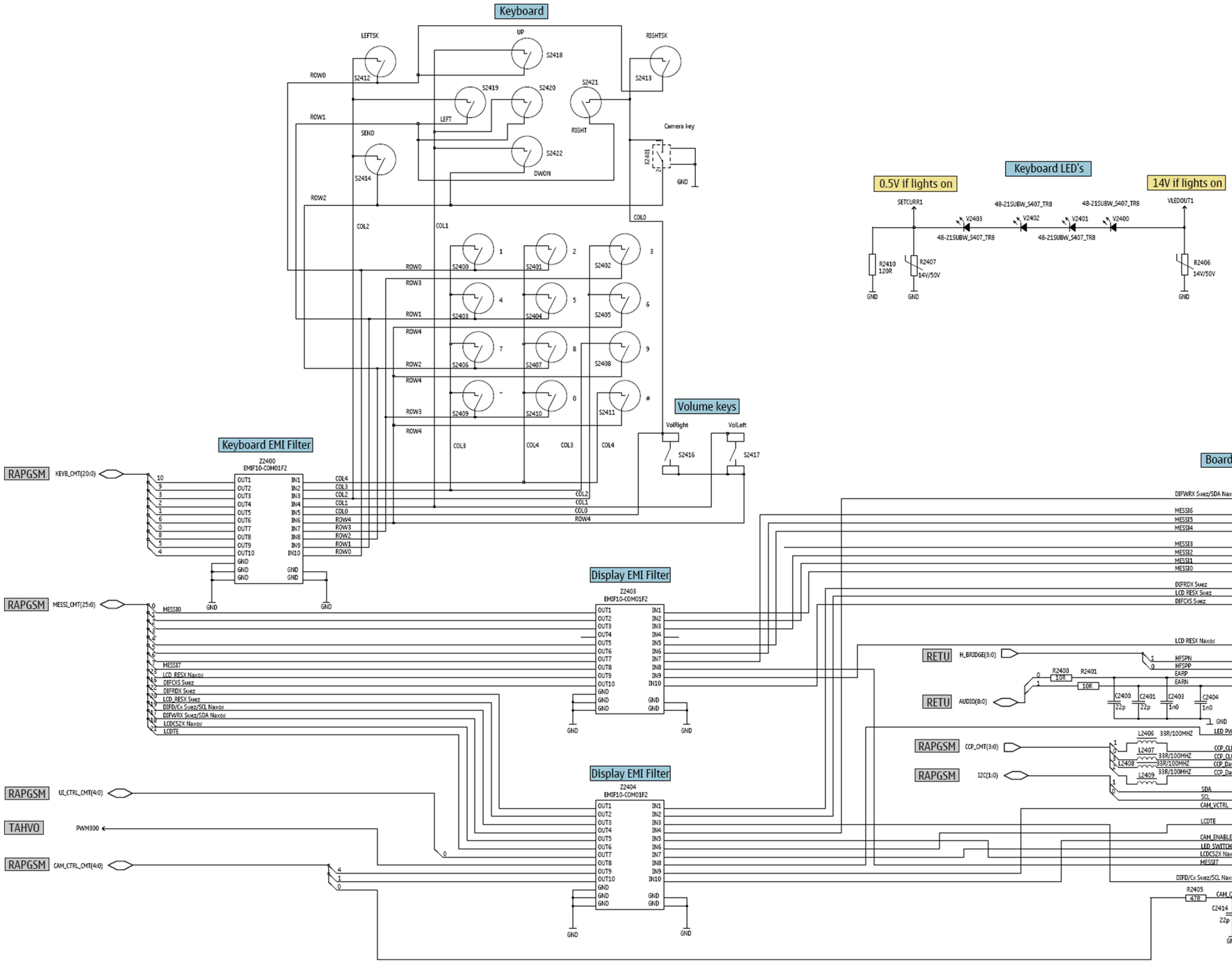
## RM-106/199 user interface





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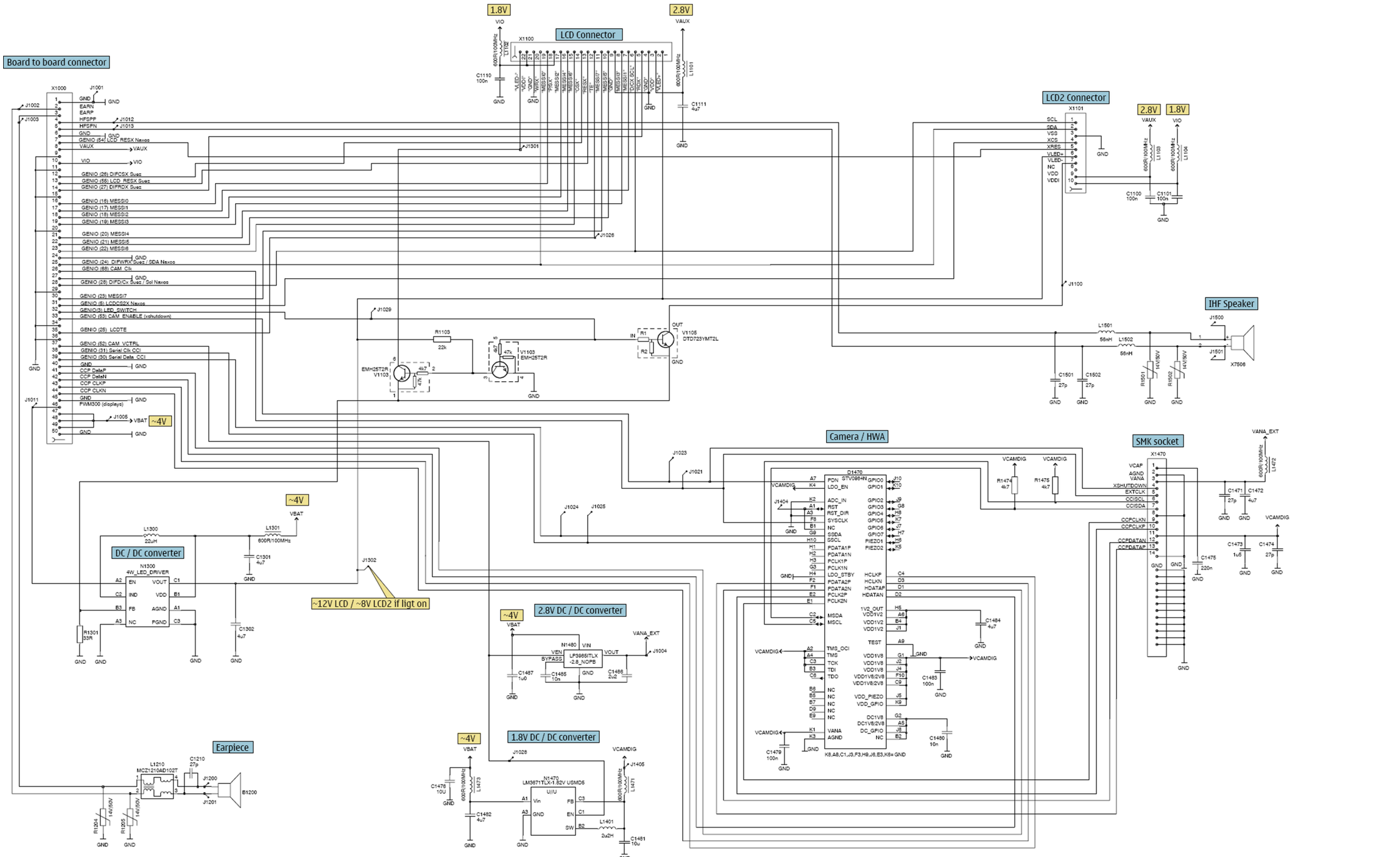
## RM-106/199 camera, earpiece, IHF speaker





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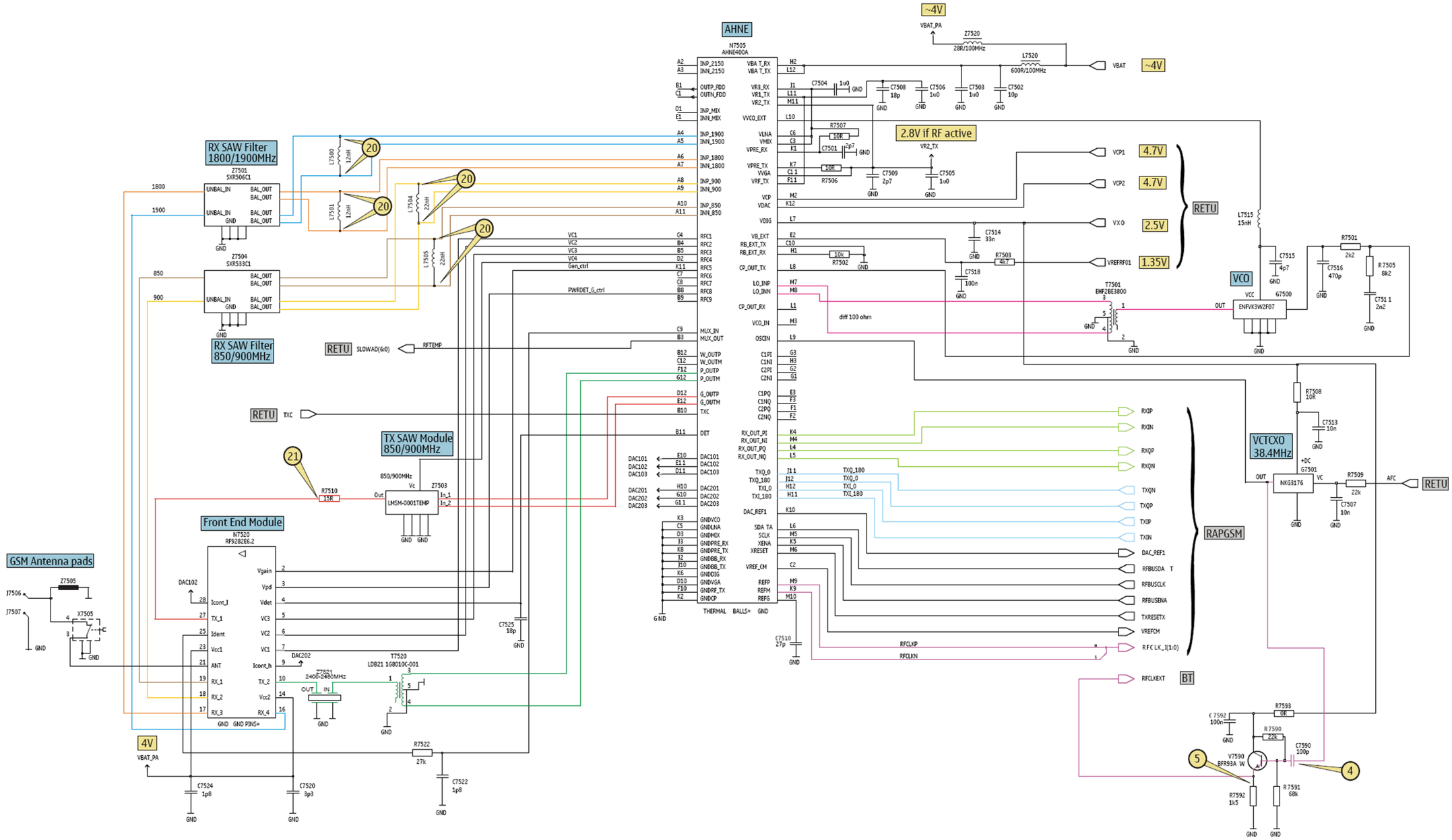
## RM-106/199 RF part

| Band | Channel | RX | VCO/RX | VC/RX | TX | VCO/TX | VC/TX |
|---|---|---|---|---|---|---|---|
| GSM 850 | 190 | 881.6MHz | 3526.4MHz | ~1.8V | 836.6MHz | 3346.4MHz | ~1.5V |
| GSM 900 | 37 | 942.4MHz | 3769.6MHz | ~2.73V | 897.4MHz | 3589.6MHz | ~1.99V |
| GSM 1800 | 700 | 1842.8MHz | 3685.6MHz | ~2.39V | 1747.8MHz | 3495.6MHz | ~1.60V |
| GSM 1900 | 661 | 1960.0MHz | 3920.0MHz | ~3.31V | 1880.0MHz | 3760.0MHz | ~2.96V |





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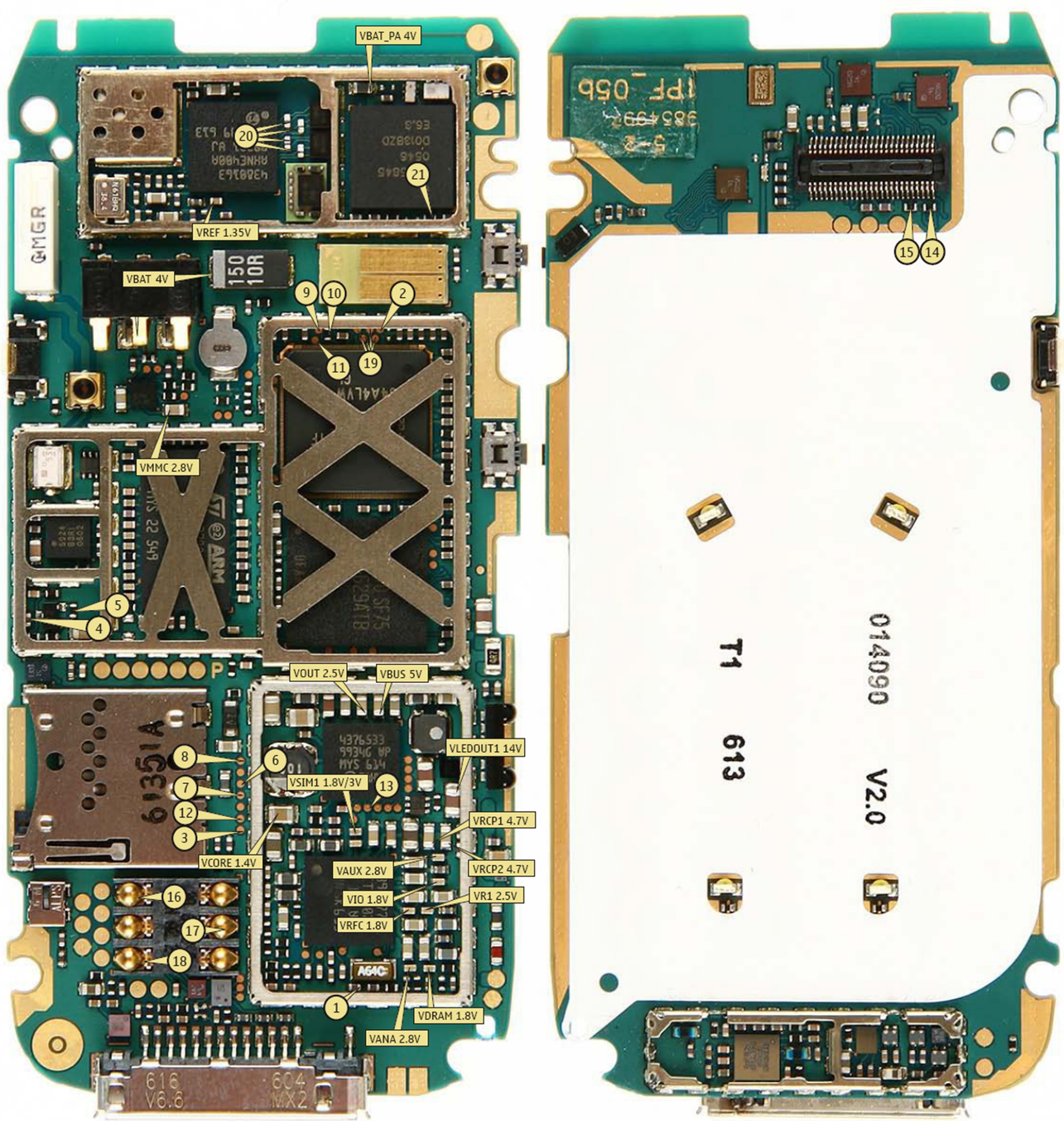
## RM-106/199 signal overview

| | | | |
|---|---|---|---|
| 1) 32 kHz at C2208 | 2) RFCLK at J2851 | 3) SleepCLK at J2217 | 4) VCTCXO 38.4 MHz at C7590 |
| 5) RFCLKEXT at R7592 | 6) CBUSCLK at J2206 | 7) CBUSDA at J2207 | 8) CBUSENX at J2209 |
| 9) RFBUSCLK at J2833 | 10) RFBUSDA at R2806 | 11) RFBUSENX at J2834 | 12) AUDIOCLK at J2200 |
| 13) SMPSCLK at J2308 | 14) FMSCL at R2701 | 15) FMSDA at R2702 | 16) SIMCLK at X2701 pin 1 |
| 17) SIMDA at X2701 pin 5 | 18) VSIM at X2701 pin 3 | 19) RXIQ GSM 900 at J2828-J2831 | 20) RX at L7500, L7501, L7504, L7505 |
| 21) TX at R7510 | 22) | 23) | 24) |





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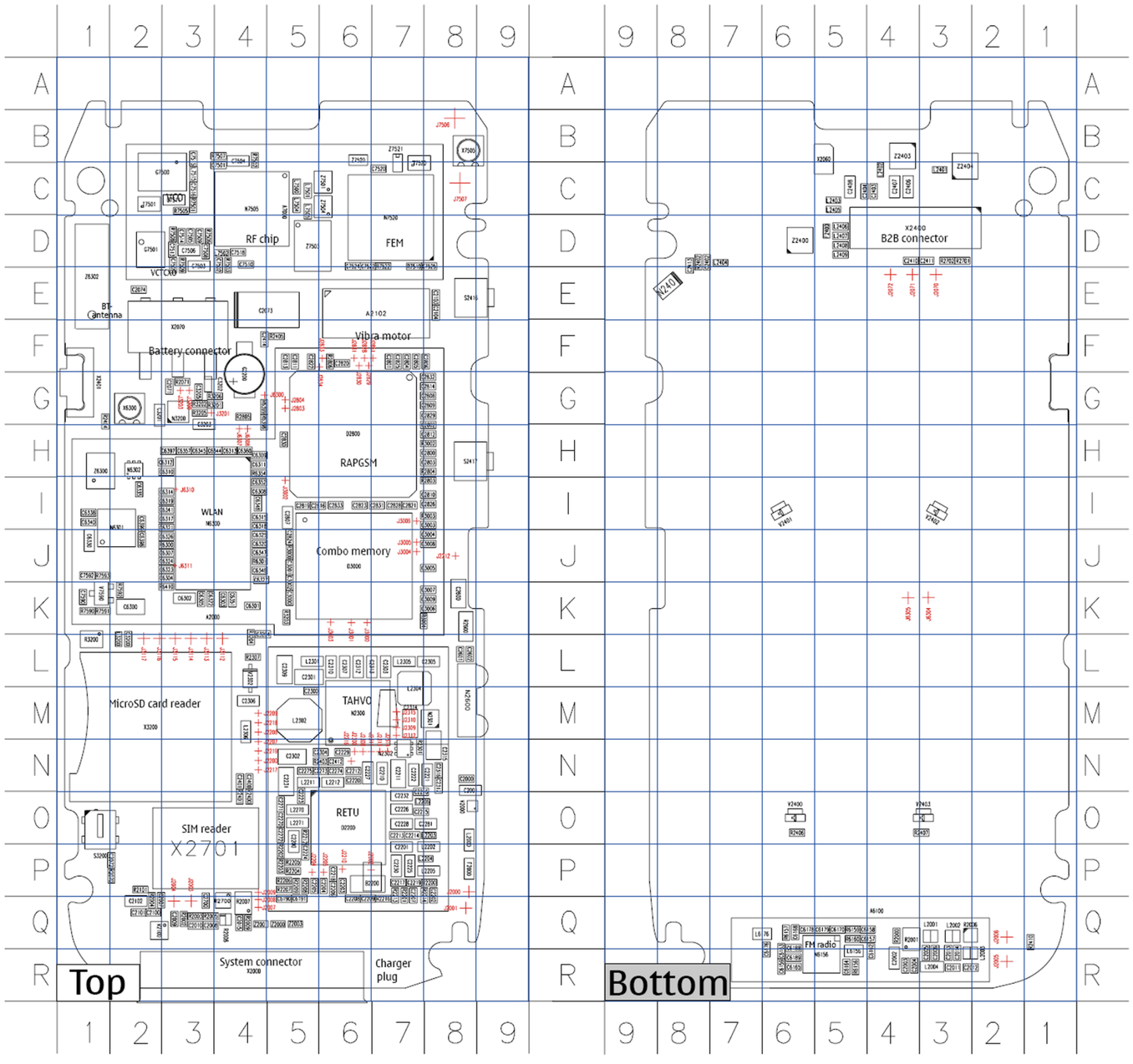
## RM-106/199 component finder

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **B** | | C2270 | O5 | C2824 | J5 | C6322 | K3 | J2004 | Q3 | J6310 | I3 | R2005 | Q3 | R6399 | G4 |
| B2200 | P6 | C2271 | O5 | C2825 | F7 | C6323 | J3 | J2005 | R2 | J6311 | J3 | R2006 | Q3 | R6410 | K3 |
| **C** | | C2272 | O5 | C2826 | I8 | C6324 | J3 | J2006 | Q2 | J7506 | B8 | R2007 | Q4 | R7501 | C3 |
| C2000 | N8 | C2273 | N6 | C2828 | I7 | C6325 | J4 | J2007 | Q4 | J7507 | C8 | R2008 | Q4 | R7502 | B4 |
| C2001 | N8 | C2274 | N6 | C2829 | G8 | C6326 | J3 | J2008 | Q4 | **L** | | R2009 | Q4 | R7503 | D4 |
| C2002 | R4 | C2275 | N5 | C2830 | H5 | C6327 | J4 | J2009 | P4 | L2000 | O8 | R2070 | P2 | R7505 | C3 |
| C2003 | R4 | C2281 | O8 | C2831 | I7 | C6330 | J1 | J2060 | P2 | L2001 | Q3 | R2071 | G3 | R7506 | D3 |
| C2004 | R4 | C2300 | M5 | C2832 | G8 | C6335 | I2 | J2070 | E3 | L2002 | Q3 | R2100 | Q2 | R7507 | B4 |
| C2005 | R3 | C2301 | L5 | C2833 | I6 | C6338 | I1 | J2071 | E4 | L2003 | R3 | R2101 | P2 | R7508 | D3 |
| C2006 | R3 | C2302 | N5 | C3000 | K5 | C6340 | I1 | J2072 | E4 | L2004 | R3 | R2200 | P8 | R7509 | D3 |
| C2007 | Q2 | C2303 | L7 | C3001 | J5 | C6341 | I3 | J2200 | N4 | L2202 | P8 | R2201 | P7 | R7510 | D7 |
| C2008 | Q3 | C2304 | N6 | C3002 | K5 | C6344 | H4 | J2204 | P5 | L2203 | O8 | R2202 | P5 | R7522 | D7 |
| C2009 | Q3 | C2305 | L8 | C3003 | I8 | C6345 | H3 | J2205 | P6 | L2204 | P8 | R2203 | P5 | R7590 | K1 |
| C2010 | Q3 | C2306 | M4 | C3004 | J8 | C6346 | J4 | J2206 | M4 | L2205 | P8 | R2204 | P5 | R7591 | K1 |
| C2011 | R3 | C2307 | L6 | C3005 | J8 | C6347 | J4 | J2207 | N4 | L2206 | O7 | R2205 | P5 | R7592 | K2 |
| C2012 | R3 | C2309 | L5 | C3006 | K8 | C6348 | I4 | J2209 | M4 | L2211 | N5 | R2206 | P5 | R7593 | J1 |
| C2013 | R3 | C2310 | L6 | C3007 | K8 | C6351 | K4 | J2210 | P6 | L2212 | N6 | R2207 | P5 | **S** | |
| C2014 | R3 | C2312 | L6 | C3008 | J8 | C6352 | I4 | J2212 | J8 | L2270 | O5 | R2208 | P5 | S2416 | E8 |
| C2015 | Q4 | C2313 | L7 | C3009 | K8 | C6357 | H3 | J2216 | N6 | L2271 | O5 | R2209 | P5 | S2417 | H8 |
| C2071 | G3 | C2314 | M7 | C3200 | L2 | C6360 | H4 | J2217 | N4 | L2301 | L5 | R2212 | O5 | S3200 | O1 |
| C2072 | P2 | C2315 | N8 | C3201 | G2 | C6397 | H3 | J2218 | M4 | L2302 | M5 | R2213 | P7 | **T** | |
| C2073 | E5 | C2316 | N8 | C3202 | G3 | C6398 | J2 | J2219 | N4 | L2304 | M7 | R2214 | P8 | T7501 | C2 |
| C2074 | E2 | C2317 | N8 | C3203 | H3 | C6399 | I2 | J2300 | N6 | L2305 | L7 | R2216 | Q7 | T7520 | C7 |
| C2100 | Q2 | C2400 | N4 | C3204 | L4 | C7501 | C4 | J2308 | N6 | L2306 | M4 | R2301 | N7 | **V** | |
| C2101 | Q2 | C2401 | N4 | C3205 | G3 | C7502 | D4 | J2309 | M7 | L2401 | C3 | R2307 | L4 | V2000 | O8 |
| C2102 | Q2 | C2402 | D8 | C6157 | Q4 | C7503 | D3 | J2310 | M7 | L2402 | C4 | R2400 | O4 | V2302 | L4 |
| C2103 | E8 | C2403 | C4 | C6158 | Q4 | C7504 | B4 | J2311 | N6 | L2403 | C5 | R2401 | O4 | V2400 | O6 |
| C2104 | E8 | C2404 | C5 | C6159 | R6 | C7505 | D3 | J2312 | M7 | L2404 | D7 | R2402 | D8 | V2401 | I6 |
| C2200 | O5 | C2406 | C4 | C6162 | R4 | C7506 | D3 | J2313 | N7 | L2405 | C5 | R2403 | N6 | V2402 | I3 |
| C2201 | P7 | C2407 | C4 | C6163 | R6 | C7507 | D3 | J2314 | N7 | L2406 | D5 | R2404 | G1 | V2403 | O3 |
| C2202 | P8 | C2408 | C5 | C6164 | R5 | C7508 | D3 | J2315 | M7 | L2407 | D5 | R2405 | F5 | V7590 | K1 |
| C2203 | P6 | C2410 | D4 | C6165 | R6 | C7509 | D3 | J2803 | G5 | L2408 | D5 | R2406 | O6 | **X** | |
| C2204 | P6 | C2411 | D3 | C6168 | Q6 | C7510 | D4 | J2804 | G5 | L2409 | D5 | R2407 | O3 | X2000 | R4 |
| C2205 | P5 | C2412 | N6 | C6170 | Q5 | C7511 | C3 | J2828 | F6 | L3200 | L2 | R2410 | Q1 | X2060 | B5 |
| C2206 | P6 | C2413 | D8 | C6176 | R6 | C7513 | D3 | J2829 | F6 | L6156 | R5 | R2600 | K8 | X2070 | F3 |
| C2207 | P7 | C2414 | F4 | C6178 | Q6 | C7514 | D3 | J2830 | F6 | L6176 | Q6 | R2700 | Q4 | X2400 | D4 |
| C2208 | Q6 | C2600 | K8 | C6179 | Q5 | C7515 | B3 | J2831 | F6 | L7500 | C5 | R2701 | D3 | X2401 | G1 |
| C2209 | Q6 | C2601 | L8 | C6188 | Q6 | C7516 | C3 | J2833 | F6 | L7501 | C5 | R2702 | D3 | X2701 | P3 |
| C2210 | N7 | C2602 | L8 | C6189 | R6 | C7518 | D4 | J2834 | F6 | L7502 | D4 | R2803 | I8 | X3200 | M2 |
| C2211 | N7 | C2700 | Q3 | C6190 | Q5 | C7520 | C7 | J2851 | F7 | L7504 | C5 | R2804 | H8 | X6300 | G2 |
| C2212 | N6 | C2800 | H8 | C6191 | Q5 | C7522 | D6 | J3000 | K6 | L7505 | C5 | R2805 | G4 | X7505 | B8 |
| C2213 | O7 | C2801 | F7 | C6300 | K2 | C7524 | D6 | J3001 | K6 | L7515 | C3 | R2806 | F6 | **Z** | |
| C2214 | O7 | C2802 | H8 | C6301 | K4 | C7525 | D8 | J3002 | I5 | **N** | | R3000 | J5 | Z2000 | Q5 |
| C2215 | O7 | C2803 | H8 | C6302 | K3 | C7590 | K1 | J3003 | K6 | N2300 | M6 | R3002 | H8 | Z2001 | Q4 |
| C2216 | O7 | C2804 | F7 | C6303 | K4 | C7592 | J1 | J3004 | J7 | N2301 | M8 | R3003 | I8 | Z2003 | Q5 |
| C2217 | P7 | C2805 | F7 | C6304 | J3 | **D** | | J3005 | J7 | N2302 | N7 | R3004 | K7 | Z2400 | D6 |
| C2218 | P6 | C2806 | F8 | C6305 | K3 | D2200 | O6 | J3006 | I7 | N2401 | E8 | R3200 | L1 | Z2403 | B4 |
| C2219 | P7 | C2807 | I5 | C6307 | J3 | D2800 | H6 | J3112 | L4 | N2600 | M8 | R3201 | G4 | Z2404 | C3 |
| C2220 | N6 | C2808 | G8 | C6308 | I4 | D3000 | J6 | J3113 | L3 | N3200 | G3 | R3202 | G3 | Z6300 | H1 |
| C2221 | N8 | C2809 | G8 | C6309 | H4 | **F** | | J3114 | L3 | N6156 | R5 | R3203 | K5 | Z6302 | E1 |
| C2222 | N7 | C2810 | I8 | C6310 | H3 | F2000 | P8 | J3115 | L3 | N6300 | I3 | R3204 | L4 | Z7501 | C6 |
| C2223 | O5 | C2811 | F5 | C6311 | H4 | F2400 | D5 | J3116 | L2 | N6301 | I2 | R3205 | G3 | Z7503 | D5 |
| C2224 | P5 | C2812 | H8 | C6312 | H3 | **G** | | J3117 | L2 | N6302 | H2 | R3206 | G4 | Z7504 | C6 |
| C2225 | P7 | C2813 | F5 | C6313 | H4 | G2200 | G4 | J3200 | G3 | N7505 | C4 | R6156 | R5 | Z7520 | B6 |
| C2226 | O7 | C2814 | G8 | C6314 | I3 | G7500 | C3 | J3201 | G3 | N7520 | D7 | R6157 | Q6 | Z7521 | C7 |
| C2227 | N6 | C2816 | I5 | C6315 | I4 | G7501 | D2 | J3203 | G3 | **R** | | R6159 | Q5 | | |
| C2228 | O7 | C2819 | I5 | C6317 | I3 | **J** | | J6300 | G4 | R2000 | Q4 | R6160 | Q5 | | |
| C2229 | N6 | C2820 | F6 | C6318 | I4 | J2000 | P8 | J6304 | K3 | R2001 | Q4 | R6300 | J3 | | |
| C2230 | P7 | C2821 | I7 | C6319 | I3 | J2001 | Q8 | J6305 | K4 | R2002 | Q3 | R6301 | J4 | | |
| C2231 | N5 | C2822 | F5 | C6320 | J4 | J2002 | P6 | J6307 | H4 | R2003 | Q3 | R6354 | H4 | | |
| C2232 | O7 | C2823 | I6 | C6321 | I3 | J2003 | Q3 | J6308 | H4 | R2004 | Q2 | R6398 | G4 | | |





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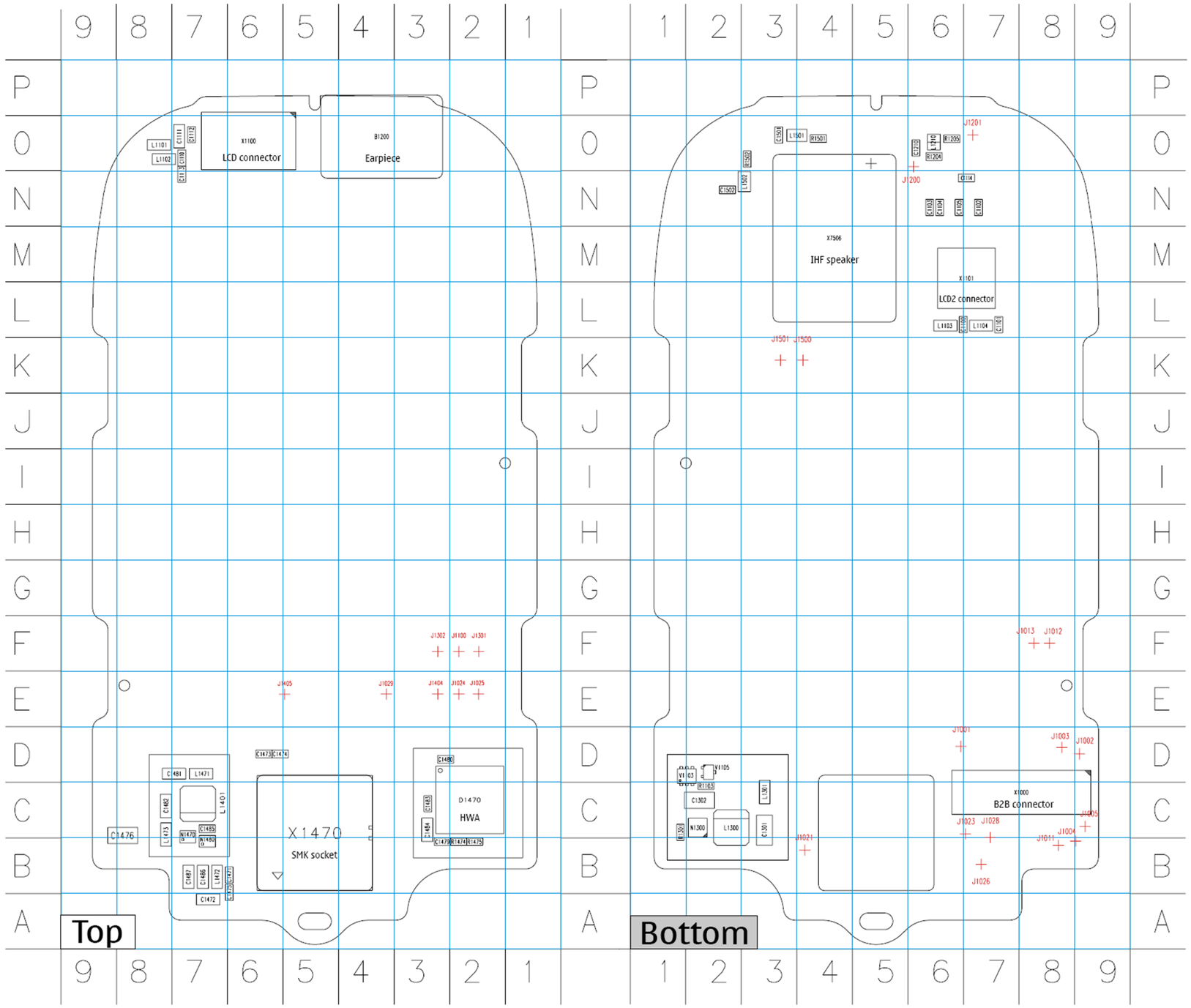
## RM-106/199 component finder user interface

| B | | J1026 | B7 |
|---|---|---|---|
| B1200 | O4 | J1028 | C7 |
| C | | J1029 | E4 |
| C1100 | L6 | J1100 | F2 |
| C1101 | L7 | J1200 | O6 |
| C1102 | N7 | J1201 | O7 |
| C1103 | N6 | J1301 | F2 |
| C1104 | N6 | J1302 | F3 |
| C1105 | N6 | J1404 | E3 |
| C1110 | O7 | J1405 | E5 |
| C1111 | O7 | J1500 | K4 |
| C1112 | O7 | J1501 | K3 |
| C1113 | N7 | L | |
| C1114 | N7 | L1101 | O8 |
| C1210 | O6 | L1102 | O8 |
| C1301 | C3 | L1103 | L6 |
| C1302 | C2 | L1104 | L7 |
| C1471 | B6 | L1210 | O6 |
| C1472 | A7 | L1300 | C2 |
| C1473 | D6 | L1301 | C3 |
| C1474 | D6 | L1401 | C7 |
| C1475 | B6 | L1471 | D7 |
| C1476 | C8 | L1472 | B7 |
| C1479 | B3 | L1473 | C8 |
| C1480 | D3 | L1501 | O4 |
| C1481 | D7 | L1502 | N3 |
| C1482 | C8 | N | |
| C1483 | C3 | N1300 | C2 |
| C1484 | C3 | N1470 | C7 |
| C1485 | C7 | N1480 | B7 |
| C1486 | B7 | R | |
| C1487 | B7 | R1103 | C2 |
| C1501 | O3 | R1204 | O6 |
| C1502 | N2 | R1205 | O6 |
| D | | R1301 | C1 |
| D1470 | C2 | R1474 | B2 |
| J | | R1475 | B2 |
| J1001 | D6 | R1501 | O4 |
| J1002 | D9 | R1502 | O3 |
| J1003 | D8 | V | |
| J1004 | B9 | V1103 | D2 |
| J1005 | C9 | V1105 | D2 |
| J1011 | B8 | X | |
| J1012 | F8 | X1000 | C8 |
| J1013 | F8 | X1100 | O6 |
| J1021 | B4 | X1101 | M7 |
| J1023 | C7 | X1470 | C5 |
| J1024 | E2 | X7506 | M4 |
| J1025 | E2 | | |





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# Glossary


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| | |
|---|---|
| A/D-converter | Analog-to-digital converter |
| ACI | Accessory Control Interface |
| ADC | Analog-to-digital converter |
| ADSP | Application DPS (expected to run high level tasks) |
| AGC | Automatic gain control (maintains volume) |
| ALS | Ambient light sensor |
| AMSL | After Market Service Leader |
| ARM | Advanced RISC Machines |
| ARPU | Average revenue per user (per month or per year) |
| ASIC | Application Specific Integrated Circuit |
| ASIP | Application Specific Interface Protector |
| B2B | Board to board, connector between PWB and UI board |
| BB | Baseband |
| BC02 | Bluetooth module made by CSR |
| BIQUAD | Bi-quadratic ,type of filter function) |
| BSI | Battery Size Indicator |
| BT | Bluetooth |
| CBus | MCU controlled serial bus connected to UPP_WD2,UEME and Zocus |
| CCP | Compact Camera Port |
| CDSP | Cellular DSP (expected to run at low levels) |
| CLDC | Connected limited device configuration |
| CMOS | Complimentary metal-oxide semiconductor circuit (low power consumption) |
| COF | Chip on Foil |
| COG | Chip on Glass |
| CPU | Central Processing Unit |
| CSR | cambridge silicon radio |
| CSTN | Color Super Twisted Nematic |
| CTSI | Clock Timing Sleep and interrupt block of Tiku |
| CW | Continuous wave |
| D/A-converter | Digital-to-analouge converter |
| DAC | Digital-to-analouge converter |
| DBI | Digital Battery Interface |
| DBus | DSP controlled serial bus connected between UPP_WD2 and Helgo |
| DCT-4 | Digital Core Technology |
| DMA | Direct memory access |
| DP | Data Package |


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| | |
|---|---|
| DPLL | Digital Phase Locked Loop |
| DSP | Digital Signal Processor |
| DtoS | Differential to Single ended |
| EDGE | Enhanced data rates for global/GSM evaluation |
| EGSM | Extended GSM |
| EM | Energy management |
| EMC | Electromagnetic compability |
| EMI | Electromagnetic interference |
| ESD | Electrostatic discharge |
| FCI | Functional cover interface |
| FPS | Flash Programming Tool |
| FR | Full rate |
| FSTN | Film compensated super twisted nematic |
| GND | Ground, conductive mass |
| GPIB | General-purpose interface bus |
| GPRS | General Packet Radio Service |
| GSM | Group Special Mobile/Global System for Mobile communication |
| HF | Hands free |
| HFCM | Handsfree Common |
| HS | Handset |
| HSCSD | High speed circuit switched data (data transmission connection faster than GSM) |
| HW | Hardware |
| I/O | Input/Output |
| IBAT | Battery current |
| IC | Integrated circuit |
| ICHAR | Charger current |
| IF | Interface |
| IHF | Integrated hands free |
| IMEI | International Mobile Equipment Identity |
| IR | Infrared |
| IrDA | Infrared Data Associasion |
| ISA | Intelligent software architecture |
| JPEG/JPG | Joint Photographic Experts Group |
| LCD | Liquid Crystal Display |
| LDO | Low Drop Out |
| LED | Light-emitting diode |


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| | |
|---|---|
| LPRF | Low Power Radio Frequency |
| MCU | Micro Controller Unit (microprocessor) |
| MCU | Multiport control unit |
| MIC, mic | Microphone |
| MIDP | Mobile Information Device Profile |
| MIN | Mobile identification number |
| MIPS | Million instructions per second |
| MMC | Multimedia card |
| MMS | Multimedia messaging service |
| NTC | Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor |
| OMA | Object management architechture |
| OMAP | Operations, maintenance, and administartion part |
| Opamp | Operational Amplifier |
| PA | Power amplifier |
| PDA | Pocket Data Application |
| PDA | Personal digital assistant |
| PDRAM | Program/Data RAM (on chip in Tiku) |
| Phoenix | Software tool of DCT4.x |
| PIM | Personal Information Management |
| PLL | Phase locked loop |
| PM | (Phone) Permanent memory |
| PUP | General Purpose IO (PIO), USARTS and Pulse Width Modulators |
| PURX | Power-up reset |
| PWB | Printed Wiring Board |
| PWM | Pulse width modulation |
| RC-filter | Resistance-Capacitance filter |
| RF | Radio Frequency |
| RF PopPort TM | Reduced function PopPortTM interface |
| RFBUS | Serial control Bus For RF |
| RSK | Right Soft Key |
| RS-MMC | Reduced size Multi Media Card |
| RSSI | Receiving signal strength indicator |
| RST | Reset Switch |
| RTC | Real Time Clock (provides date and time) |
| RX | Radio Receiver |


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| | |
|---|---|
| SARAM | Single Access RAM |
| SAW filter | Surface Acoustic Wave filter |
| SDRAM | Synchronous Dynamic Random Access Memory |
| SID | Security ID |
| SIM | Subscriber Identity Module |
| SMPS | Switched Mode Power Supply |
| SNR | Signal-to-noice ratio |
| SPR | Standard Product requirements |
| SRAM | Static random access memory |
| STI | Serial Trace Interface |
| SW | Software |
| SWIM | Subscriber/Wallet Identification Module |
| TCXO | Temperature controlled Oscillator |
| Tiku | Finnish for Chip, Successor of the UPP, Official Tiku3G |
| TX | Radio Transmitter |
| UART | Universal asynchronous receiver/transmitter |
| UEME | Universal Energy Management chip (Enhanced version) |
| UEMEK | See UEME |
| UI | User Interface |
| UPP | Universal Phone Processor |
| UPP_WD2 | Communicator version of DCT4 system ASIC |
| USB | Universal Serial Bus |
| VBAT | Battery voltage |
| VCHAR | Charger voltage |
| VCO | Voltage controlled oscillator |
| VCTCXO | Voltage Controlled Temperature Compensated Crystal Oscillator |
| VCXO | Voltage Controlled Crystal Oscillator |
| Vp-p | Peak-to-peak voltage |
| VSIM | SIM voltage |
| WAP | Wireless application protocol |
| WD | Watchdog |
| XHTML | Extensible hypertext markup language |
| Zocus | Current sensor, (used to monitor the current flow to and from the battery) |


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